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AN 08-30APS15-2

HANDBOOK OF OPERATING INSTRUCTIONS

FOR

MODEL AN/APS-15 AIRCRAFT RADAR EQUIPMENT

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Approved 29 FEBRUARY 1944

UNSATISFACTORY REPORT

FOR U. S. ARMY AIR FORCE PERSONNEL:

In the event of malfunctioning, unsatisfactory design, or unsatisfactory installation of any of the component units of this equipment, or if the material contained in this book is considered inadequate or erroneous, an Unsatisfactory Report, AAF Form No. 54, or a report in similar form, shall be submitted in accordance with the provisions of Army Air Force Regulation No. 15-54, listing:

1. Station and organization.
2. Nameplate data (type number or complete nomenclature if nameplate is not attached to the equipment).
3. Date and nature of failure.
4. Airplane model and serial number.
5. Remedy used or proposed to prevent recurrence.
6. Handbook errors or inadequacies, if applicable.

FOR U. S. NAVY PERSONNEL:

Report of failure of any part of this equipment during its guaranteed life shall be made on Form N. Aer. 4112, "Report of Unsatisfactory or Defective Material," or a report in similar form, and forwarded in accordance with the latest instructions of the Bureau of Aeronautics. In addition to other distribution required, one copy shall be furnished to the Resident Inspector of Naval Material, Philco Corporation, C and Tioga Streets, Philadelphia, Pennsylvania, and the Bureau of Ships. Such reports of failure shall include:

1. Reporting activity.
2. Nameplate data.
3. Date placed in service.
4. Part which failed.
5. Nature and cause of failure.
6. Replacement needed (yes-no).
7. Remedy used or proposed to prevent recurrence.

FOR BRITISH PERSONNEL:

Form 1022 procedure shall be used when reporting failure of radio equipment.

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WARNING

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE THE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION BUT ALWAYS SHUT DOWN MOTOR GENERATORS OR OTHER POWER EQUIPMENT. UNDER CERTAIN CONDITIONS DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITION DUE TO CHARGES RETAINED BY CAPACITORS, ETC. TO AVOID CASUALTIES ALWAYS DISCHARGE AND GROUND CIRCUITS PRIOR TO TOUCHING THEM. THE ATTENTION OF OFFICERS AND OPERATING PERSONNEL IS DIRECTED TO BUREAU OF ENGINEERING CIRCULAR LETTER NO. 5a OF 3 OCTOBER, 1934, OR SUBSEQUENT REVISIONS THEREOF ON THE SUBJECT OF "RADIO-SAFETY PRECAUTIONS TO BE OBSERVED."

DESTRUCTION OF ABANDONED MATERIAL IN THE COMBAT ZONE

In case it should become necessary to prevent the capture of this equipment and when ordered to do so, **DESTROY IT SO THAT NO PART OF IT CAN BE SALVAGED, RECOGNIZED OR USED BY THE ENEMY. BURN ALL PAPERS AND BOOKS.**

Means:

1. Explosives, when provided.
2. Hammers, axes, sledges or whatever heavy objects are readily available.
3. Burning by means of incendiaries such as gasoline, oil, paper, or wood.
4. Grenades and shots from available arms.
5. Where possible, and when time permits, bury all debris or dispose of it in streams or other bodies of water.

Procedure:

1. Obliterate all identifying marks. Destroy nameplates and circuit labels.
2. Demolish all panels, castings, switch and instrument boards.
3. Destroy all controls, switches, relays, connections and meters.
4. Rip out all wiring in electrical equipment. Smash gas, oil, and water cooling systems in gas-engine generators, etc.
5. Smash every electrical or mechanical part whether rotating, moving or fixed.
6. Break up all operating instruments such as keys, phones, microphones, etc.
7. Destroy all classes of carrying cases, straps, containers, etc.

DISPOSITION OF BURNED-OUT AND DEFECTIVE MAGNETRONS

1. The Bureau of Aeronautics requests that every effort be made to provide security in the handling and disposition of all magnetrons. All magnetrons in operative condition must be strictly accounted for and safeguarded at all times.

2. Magnetrons which fail due to normal life use, or are found defective on first attempted use during operation will be promptly disposed of by dropping overboard in deep water, or when facilities permit, they may be destroyed by melting. Complete destruction of the form of the tube is important. This should be done in the presence of a commissioned officer and so reported on vacuum tube failure report form N. Eng. 204 or NBS-304.

3. Magnetrons which are found defective during initial test of the radar installation or during service periods in Navy yards, bases, or air stations, will be delivered personally along with the proper copy of form N. Eng. 204 or NBS-304 to the radio material officer for similar disposition at the yard, base, or air station.

4. It is important that this information be referred to those handling radar material and to the personnel directly responsible for the care and operation of radar equipment.

ELECTRIC SHOCK FIRST-AID TREATMENT

SAFETY FIRST

Regard electrical apparatus generally, and especially all current-carrying parts, as dangerous, irrespective of voltage. Exercise great care in handling, and avoid broad contacts such as are made by standing on a metal deck or in water.

Dangerous contact may result through lessened resistance when the skin and clothing are wet with perspiration. Contact with damp metal surfaces—decks, bulkheads, guns, machinery—may allow the current to ground through the moist skin and body.

Electric shock is due to current passing through the body—current actually passing—irrespective of the voltage. A pressure as low as 110 volts has caused death. Current passing through the body in the region of the heart is especially dangerous. In using electric breast drills avoid the possibility of a ground.

Usually electric shock does not kill instantly. Life can often be saved even though breathing has stopped.

I. FREE THE VICTIM FROM THE CIRCUIT IMMEDIATELY.

Use a dry nonconductor (rubber gloves, clothing, rope, board) to move either the victim or the wire. Beware of using metal or moist material.

Shut off the current.

If necessary to cut a live wire, use an ax or hatchet with a dry wooden handle; turn your face away from the electrical flash.

II. ATTEND INSTANTLY TO THE VICTIM'S BREATHING.

Begin resuscitation at once on the spot. Do not stop to loosen clothing; every moment counts.

RESUSCITATION BY THE PRONE PRESSURE METHOD OF ARTIFICIAL RESPIRATION

GAS ASPHYXIATION

Waste no time. When the patient is removed from the water, gas, smoke, or electric contact, get to work at once with your own hands. Send for the medical officer or nearest physician.

No reliance should be placed upon any special mechanical apparatus, as it is frequently out of order and often is not available when most needed. The patient's mouth should be cleared of any obstruction such as chewing gum or tobacco, false teeth, or mucus, so that there is no interference with the entrance and escape of air.

ELECTRIC SHOCK

DROWNING



FIGURE 1

POSITION

1. Lay the patient on his belly, one arm extended directly overhead, the other arm bent at elbow and with the face turned outward and resting on hand or forearm, so that the nose and mouth are free for breathing. (See Inset, fig. 1.)

2. Kneel straddling the patient's thighs with your knees placed at such a distance from the hip bones as will allow you to assume the position shown in Figure 1.

Place the palms of the hands on the small of the back with fingers resting on the ribs, the little finger just touching the lowest rib, with the thumb and fingers in a natural position, and the tips of the fingers just out of sight. (See fig. 1.)

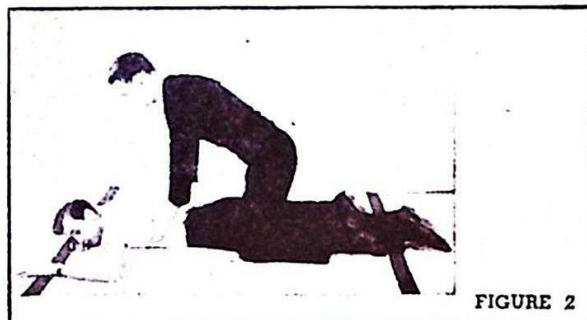


FIGURE 2

FIRST MOVEMENT

3. With arms held straight, swing forward slowly, so that the weight of your body is gradually brought to bear upon the patient. The shoulder should be directly over the heel of the hand at the end of the forward swing. (See fig. 2.) Do not bend your elbows. This operation should take about two seconds.



FIGURE 3

SECOND MOVEMENT

4. Now immediately swing backward, so as to remove the pressure completely. (See fig. 3.)

5. After two seconds, swing forward again. Thus repeat deliberately twelve to fifteen times a minute the double movement of compression and release, a complete respiration in four or five seconds.

6. Continue artificial respiration without interruption until natural breathing is restored. Do not get discouraged at the slow results that sometimes happen when resuscitating the apparently drowned. Efforts often have to be continued a long time before signs of life are apparent. Do not discontinue the efforts until certain that all chance is lost. Sometimes, even after several hours' work, recovery takes place.

7. As soon as this artificial respiration has been started and while it is being continued, an assistant should loosen any tight clothing about the patient's neck, chest, or waist. TO KEEP THE PATIENT WARM DURING ARTIFICIAL RESPIRATION IS MOST IMPORTANT AND IT MAY BE NECESSARY TO COVER HIM WITH BLANKETS AND WORK THROUGH THEM, AS WELL AS TO APPLY HOT-WATER BOTTLES, HOT BRICKS, ETC. Do not give any liquids whatever by mouth until the patient is fully conscious.

8. To avoid strain on the heart when the patient revives, he should be kept lying down and not allowed to stand or sit up. If the doctor has not arrived by the time the patient has revived, he should be given some stimulant, such as one teaspoonful of aromatic spirits of ammonia in a small glass of water or a hot drink of coffee or tea, etc. Continue to keep the patient warm and at rest.

9. Resuscitation should be carried on at the nearest possible point to where the patient received his injuries. As a general rule he should not be moved from this point until he is breathing normally of his own volition and then moved only in a lying position. Should it be necessary, due to extreme weather conditions, etc., to move the patient before he is breathing normally, resuscitation should be carried on during the time that he is being moved.

10. A brief return of natural respiration is not a certain indication for stopping the resuscitation. Not infrequently the patient, after a temporary recovery of respiration, stops breathing again. The patient must be watched, and if natural breathing stops, artificial respiration should be resumed at once.

11. In carrying out resuscitation it may be necessary to change the operator. This change must be made without losing the rhythm of respiration. The relief operator should kneel behind the one giving the artificial respiration and at the end of the movement, the operator crawls forward while the relief takes his place. By this procedure no confusion results at the time of change of operator, and a regular rhythm is kept up.

PRACTICE IN THE PERFORMANCE OF ARTIFICIAL RESPIRATION ON A VOLUNTEER SUBJECT SHOULD BE OBTAINED BY EVERYONE.

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WOUNDS

Neglected wounds can have serious consequences. Any break in the skin is a wound. Paint small cuts and scratches immediately with **TINCTURE OF IODINE**. Deep cuts and wounds should be **KEPT CLEAN**, but **DO NOT** use Tincture of Iodine on them. Washing **AROUND** and **AWAY FROM** the wound with ordinary soap and water is recommended, if no other antiseptic is available. Other antiseptics for use on deep wounds are: Violet Gentian, Potassium Permanganate, Tincture of Merthiolate, or ordinary baking soda and water. Cover the wound with a sterile gauze dressing and hold in place with adhesive tape or a strip of gauze.

In cases of serious bleeding, when an artery has been cut, firm pressure is necessary to stop the flow of blood. Arterial bleeding is **BRIGHT RED** and comes from the wound in **SPURTS**, with each beat of the heart. Bleeding from a vein is **DARK RED** and flows steadily. Pressure is not often needed for venous bleeding.

Pressure is applied **ABOVE** the wound, or between the **WOUND AND THE HEART**, to stop **ARTERIAL BLEEDING**. Pressure is applied **BELOW** the wound, or **AWAY FROM THE HEART** to stop **VENOUS BLEEDING**.

Pressure is best applied and maintained by means of a **TOURNIQUET**.

A **TOURNIQUET** is a strip of cloth, bandage, or other material, tied **ABOVE** the wound. Tie a simple, double knot in the cloth and place a strong stick or other rigid member in the loop thus made, then tighten the knot by pulling the ends of the cloth.

With the rigid member thus held firmly in place, twist it, until the bleeding stops.

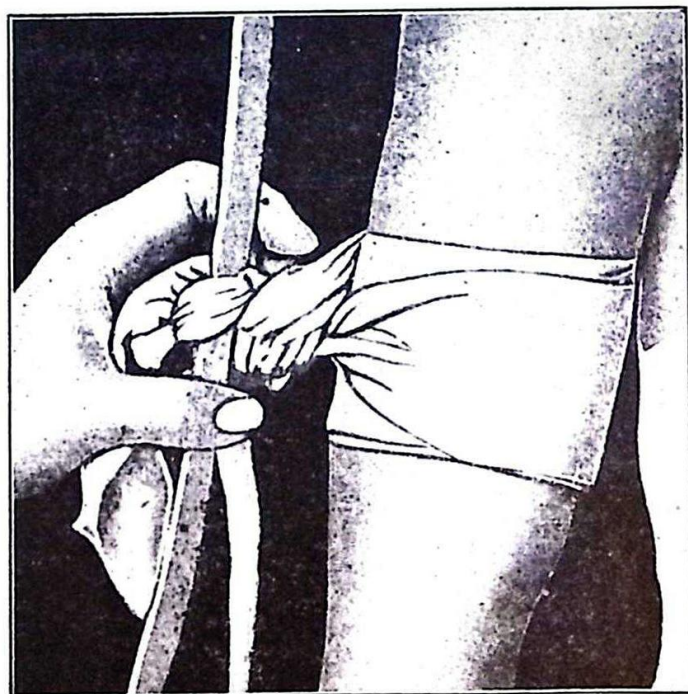
DO NOT maintain such pressure longer than 15 minutes at a time.

IF BLEEDING CONTINUES after loosening tourniquet, allow the blood to flow for about 30 to 60 seconds and then re-apply pressure. Continue until bleeding stops.

AFTER BLEEDING HAS STOPPED, the wound should be carefully covered with a sterile dressing. **DO NOT TOUCH WOUND OR DRESSING WITH DIRTY HANDS!**

Keep the victim **LYING FLAT ON HIS BACK, AND WELL COVERED**. **DO NOT LET HIM SEE HIS WOUND**. Divert his thoughts from himself.

Obtain the services of a **DOCTOR AS SOON AS POSSIBLE**.



Application of tourniquet

BURNS

Burns, whether caused by contact with high voltage electrical equipment, fire, or friction, require immediate attention.

1. Apply **AT ONCE** any one of the following:
 - a. Tannic acid jelly.
 - b. Butesin picrate.
 - c. Paste made with baking soda and water.
 - d. Very strong, cool tea.

2. Application should be **LIBERAL** and the burned area covered with **STERILE GAUZE**.

3. If clothing sticks to the burned areas, **DO NOT ATTEMPT TO REMOVE IT**. Treat burn as above.

4. Keep the victim **WELL COVERED** and **LYING FLAT ON HIS BACK**. Soothe and reassure him.

5. Obtain the services of a **DOCTOR AS SOON AS POSSIBLE**.

STANDARD NAVY "ONE YEAR SERVICE" RADIO GUARANTEE

The equipment including all parts and spare parts, except vacuum tubes, batteries, rubber and material normally consumed in operation, is guaranteed for a period of one year from the date of delivery of the equipment to and acceptance by the Government with the understanding that all such items found to be defective as to material, workmanship or manufacture will be repaired or replaced, f.o.b. any point within the continental limits of the United States designated by the Government, without delay and at no expense to the Government; provided that such guarantee will not obligate the contractor to make repair or replacement of any such defective items unless the defect appears within the aforementioned period and the contractor is notified thereof in writing within a reasonable time and the defect is not the result of normal expected shelf life deterioration.

To the extent the equipment, including all parts and spare parts, as defined above, is of the contractor's design or is of a design selected by the contractor, it is also guaranteed, subject to the foregoing conditions, against defects in design with the understanding that if ten per cent (10%) or more of any such said item, but not less than two of any such item, of the total quantity comprising such item furnished under the contract, are found to be defective as to design, such item will be conclusively presumed to be of defective design and subject to one hundred per cent (100%) correction or replacement by a suitably redesigned item.

All such defective items will be subject to ultimate return to the contractor. In view of the fact that normal activities of the Naval Service may result in the use of equipment in such remote portions of the world or under such conditions as to preclude the return of the defective items for repair or replacement without jeopardizing the integrity of Naval communications, the exigencies of the Service, therefore, may necessitate expeditious repair of such items in order to prevent extended interruption of communications. In such cases the return of the defective items for examination by the contractor prior to repair or replacement will not be mandatory. The report of a responsible authority, including details of the conditions surrounding the failure, will be acceptable as a basis for affecting expeditious adjustment under the provisions of this contractual guarantee.

The above one year period will not include any portion of time the equipment fails to perform satisfactorily due to any such defects, and any items repaired or replaced by the contractor will be guaranteed anew under this provision.

Form G4B
Revised, March 1943

SECTION I

GENERAL DESCRIPTION

1. INTRODUCTION.

The purpose of this operating manual is to supply information for the installation, operation, and emergency repair of the Model AN/APS-15 Aircraft Radar Equipment. The theory of operation and complete maintenance information, including photographs and schematic diagrams, are contained in a maintenance manual for this equipment.

2. EQUIPMENT SUPPLIED.

Table I gives the dimensions, weight, and numerical series of reference symbols for each unit of the equipment. Table II gives the weight per foot of each cable together with the AN number and weight of each cable plug. Table III gives the operating spare parts supplied with the equipment.

TABLE I
MAJOR UNITS SUPPLIED

Quantity	° Name of Unit	*Overall Dimensions (inches)			** Weight (lbs.)	Numerical Series of Reference Symbols
		Height	Width	Depth		
1	Antenna Assembly AS-18A/- APS (2 types of reflectors supplied)	40 $\frac{1}{32}$	28 $\frac{3}{4}$	25 $\frac{3}{8}$	81	601-650
1	Torque Amplifier AM-19/- APA-14	5 $\frac{1}{2}$	5 $\frac{3}{16}$	9 $\frac{1}{16}$	5.5	1401-1500
1	Azimuth Differential Unit CN-4/APA-14	5 $\frac{1}{4}$	7 $\frac{1}{2}$	9 $\frac{15}{16}$	6.75	601-650
1	Relay RE-5/APA-13	2 $\frac{9}{16}$	4 $\frac{3}{16}$	5 $\frac{3}{4}$	2.25	601-650
1	Servo Amplifier AM-21/APA- 15	6 $\frac{5}{16}$	4 $\frac{19}{32}$	7 $\frac{3}{16}$	7	651-700
1	Gyro Torque Unit CN-5/APA-15	7 $\frac{3}{4}$	8 $\frac{3}{4}$	15 $\frac{3}{16}$	13	651-700
1	Rotary Converter PU-14/APA-15	6 $\frac{1}{16}$	5 $\frac{1}{4}$	9 $\frac{1}{8}$	9.5	1501-1600
1	Transmitter-Converter RT-15/APS-15	15 $\frac{3}{4}$	15 $\frac{3}{4}$	17 $\frac{3}{4}$	82	Mod. 801-850 Converter 1101-1200
1	Receiver-Indicator R-16/APS-15	13 $\frac{3}{8}$	19 $\frac{1}{2}$	22 $\frac{3}{16}$	75	201-400 I-F strip 701-800

Section I
Paragraph 2

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TABLE I—Continued

Quantity	° Name of Unit	*Overall Dimensions (inches)			** Weight (lbs.)	Numerical Series of Reference Symbols
		Height	Width	Depth		
1	Plan Repeater Indicator ID-30/APS-2D	6 $\frac{15}{16}$	6 $\frac{7}{8}$	14 $\frac{3}{16}$	9	501-600
1	Range Unit CP-5/APS-15 or CP-5A/APS-15	7 $\frac{13}{16}$	5	21 $\frac{5}{8}$	23	401-500
1	Computer CP-3/APS-15	6 $\frac{1}{4}$	8 $\frac{1}{2}$	9	10.5	1001-1100
1	Control Unit C-33A/APS-15	5 $\frac{7}{16}$	7 $\frac{15}{16}$	8 $\frac{5}{16}$	4	901-1000
1	Milliammeter TS-116/APS-15 (Crystal-Current Meter)	3 $\frac{1}{4}$	4 $\frac{1}{4}$	2 $\frac{3}{4}$.75	1701-1750
1	†Junction Box J-15/APS-15	8 $\frac{3}{8}$	7 $\frac{3}{8}$	5 $\frac{1}{2}$	††7.5	1201-1300
1	†Junction Box J-35/APA-14 (Torque Amplifier)	2 $\frac{5}{16}$	6 $\frac{7}{16}$	9 $\frac{11}{32}$	††2.1	1301-1400
1	‡Mounting Base MT-131/- APA-15 (for Servo Ampli- fier and Gyro Torque Unit)	1 $\frac{7}{8}$	6 $\frac{3}{4}$	20 $\frac{1}{4}$	2	
1	Mounting Base MT-132/APS- 2 (for Receiver-Indicator)	12 $\frac{13}{64}$	19 $\frac{15}{32}$	22 $\frac{1}{2}$	4.5	
1	Mounting Base ★MT-51/UR (for Range Unit)	2 $\frac{5}{8}$	5 $\frac{3}{4}$	22 $\frac{5}{8}$	3.25	
1	Mounting Base MT-123/-APS- 15 (for Computer and Con- trol Unit)	1 $\frac{1}{16}$	8 $\frac{1}{2}$	18 $\frac{3}{8}$	1	
1	Mounting Base MT-95/APS-3 (for Plan Repeater Indica- tor)	1 $\frac{3}{4}$	5 $\frac{1}{8}$	9 $\frac{15}{16}$.4	
2	Visor	6 $\frac{1}{2}$	6 $\frac{1}{2}$	11 $\frac{1}{4}$	1	
	‡‡Approximate weight of com- plete equipment (less inter- connecting cables)				345	

* Overall dimensions of units do not include Mounting Bases attached.

** Weights of units do not include Mounting Bases attached.

° Units of Tilt-Stabilization Assembly AN/APA-15 (XN-1) are tabulated in section IV.

°° Weight includes Azimuth Differential Unit and Relay.

† Overall dimensions include conduit couplings without cables.

†† Weight includes attached cables and plugs.

‡ Without brackets.

‡‡ Less tilt stabilization, 321 pounds.

TABLE II
CABLES AND PLUGS SUPPLIED

Cable	Weight of Cable (lbs. per foot)	AN Plug Number	Weight of Plug (lbs.)
A	.194	3108-28-4P 3108-28-4S	.30 .37
B	.208	3108-28-2P 3108-28-2S	.31 .38
C	.207	3108-20-1P 3108-20-1S	.20 .22
D	.302	3108-28-2P 3100-28-2S	.31 .26
D-1	.302	3108-28-2P	.31
E	.093	3108-18-16P 3100-18-16S	.12 .10
E-1	.093	3108-18-16P	.12
G	.050	3108-12S-4P 3108-14S-1S	.06 .07
H	.145	*3108-22-5S #3108-28-1P	.23 .33
I	.206	3108-28-2S	.38
J	.275	3108-14S-2P	.06
K	.160	3108-22-5S	.23
L	.09	3108-14S-2S	.07
M	.11	3108-18-12S	.15
M-1	.11	3108-18-12S	.15
N	.08	3108-18-4S	.15
P	.114	3108-16S-1S	.10
S	.041	3108-8S-1P	.03
T	.291	3108-36-1S	.61
AA	.111	3108-24-5S 3106-24-5P	.37 .19
AB	.170	3106-18-1P 3106-18-1S	.11 .13

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TABLE II—Continued

Cable	Weight of Cable (lbs. per foot)	AN Plug Number	Weight of Plug (lbs.)
AC	.134	3106-16S-1P 3106-16S-1S	.06 .06
AD	.093	3106-14S-2P 3106-14S-2S	.04 .05
AE	.093	3106-14S-2S 3106-14S-2S	.05 .05
AF	.066	3106-12S-3P 3106-12S-3S	.04 .04
AG	.134	3106-18-1S 3106-18-1S	.13 .13
AH	.164	3106-18-1P 3106-18-1S	.11 .13
AJ	.166	3106-18-1P 3106-18-1S	.11 .13
AK	.089	3106-14S-1P 3106-14S-1S	.04 .05
AM	.093	3106-14S-2P 3106-14S-2S	.04 .05
AN	.089	3106-18-3S	.12
AO	.081	3106-20-5P	.11
AP	.115	3108-20-4S 3106-20-4S	.22 .16
AR	.089	3106-18-3S	.12
*AU	.066	3108-12S-3P 3106-12S-3S	.06 .04
AV	.093	3108-14S-2S	.07
AW	.140	3108-18-1P 3106-18-1P	.13 .11
AX	.050	3108-12S-3P +358-7781	.06 .12

*Not required for AAF installations.

#Used only with AAF installations; supplied by AAF.

+Philco Part Number.

TABLE III
OPERATING SPARE PARTS SUPPLIED

Quantity	Description	Philco Part No.
2	Vacuum Tube JAN-1B24	354-1370
2	Vacuum Tube JAN-2AP1	354-1322
2	Vacuum Tube JAN-2X2/879	354-1316
2	Vacuum Tube JAN-5FP7	354-1323
2	Vacuum Tube JAN-5U4-G	354-1312
2	Vacuum Tube JAN-5Y3-GT	354-1366
3	Vacuum Tube JAN-6AC7	354-1320
2	Vacuum Tube JAN-6AG7	354-1334
2	Vacuum Tube JAN-6H6	354-1319
3	Vacuum Tube JAN-6L6-GA or JAN-6L6	354-1318 or 354-1398
2	Vacuum Tube JAN-6SA7-GT	354-1360
3	Vacuum Tube JAN-6SN7-GT	354-1321
2	Vacuum Tube JAN-6X5-GT	354-1317
2	Vacuum Tube JAN-12SN7-GT	354-1394
2	Vacuum Tube JAN-72-R	354-1327
2	Vacuum Tube JAN-715-B	354-1326
2	Vacuum Tube JAN-723-A/B	354-1393
2	Vacuum Tube JAN-724-B	354-1305
2	Vacuum Tube JAN-725-A	354-1344
2	Vacuum Tube JAN-829	354-1325
2	Vacuum Tube JAN-884	354-1363
2	Vacuum Tube JAN-2050	354-1337
2	Vacuum Tube JAN-OC3/VR-105 (VR-105-30)	354-1314
2	Vacuum Tube JAN-OD3/VR-150 (VR-150-30)	354-1313
10	Crystal Rectifier Capsule 1N23 (for Transmitter-Converter)	455-1054
3	Crystal XLS (for Range Unit)	455-1049

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TABLE III—Continued

Quantity	Description	Philco Part No.
2	Neon Lamp	354-1088
2	Pilot Lamp	354-1002
1	Blower Motor Assy. (for Receiver-Indicator)	358-2243
1	Blower Motor Assy. (for Transmitter-Converter)	358-7785
1	Blower Motor Assy. (for Transmitter-Converter)	358-8125
1	Blower Motor Assy. (for Range Unit)	358-7031
2	Brush (for Tilt Motor)	247-1040
2	Brush (for Drive Motor)	247-1088
6	Brush (for Receiver-Indicator and Transmitter-Converter Blower Motor)	451-1055
1	Brush (for Range Unit Blower Motor)	451-1165
1	Brush (for Range Unit Blower Motor)	451-1176
10	Fuse (20a)	455-2021
10	Fuse (15a)	455-2010
30	Fuse (10a)	455-2017
20	Fuse (3a)	455-2031
20	Fuse (5a)	455-2008
30	Fuse (2a)	455-2032
10	Fuse (1a)	455-2033
1	Dryer Shield Assembly	453-3697
1	Spacer	258-7132
1	Valve Core	348-1130
1	Valve Cap	248-1336

3. EQUIPMENT NOT SUPPLIED.

Table IV gives the quantities and characteristics of other equipment required but not supplied with the Model AN/APS-15 Aircraft Radar Equipment.

TABLE IV
EQUIPMENT REQUIRED BUT NOT SUPPLIED

Quantity	Name of Unit	Required Characteristics
1	Power Supply	115 volts a. c., 400-2400 cycles per second.
1	Power Supply	24 volts d. c.
1	Flux-gate Compass Equipment	
1	*Inverter PE-218-C	24 volts d. c., 90 amperes, approximately.
1	*Switch Box BC-1228	
1	*Mounting Base FT-398* (for Inverter)	
1	*Phantom Target RF-3/AP	
	Antenna AS-15/AP	
	Switch	Mallory Part No. 2004, or equal.
	Jack	Army-Navy Tentative Standard Type N.

* Used only with AAF installations; supplied by AAF.

SECTION II INSTALLATION AND ADJUSTMENT

1. GENERAL INSTALLATION REQUIREMENTS.

The Model AN/APS-15 equipment is designed for maximum flexibility of installation. The actual location of the units may vary for each type of aircraft in which the equipment is installed. The major units, with the exception of the Rotary Converter, Junction Box (Torque Amplifier), Computer, and Control Unit, are provided with shock-mounted bases to reduce vibration. Connections between units of the equipment are made by flexible, shielded cables with plugs. As a general rule, cable lengths should be held to a minimum, and sharp bends avoided. All units are readily removable from their mountings. In order to obtain adequate space for removal of plugs, covers, and units for servicing, and to permit the units to rock freely on their shock mounts without striking fixed objects, ample clearance space must be provided; minimum clearances are indicated on the dimensional drawings. Units which are rigidly attached to the aircraft structure are bonded to the structure by ground straps. Surfaces which are bonded together should first be cleared of paint or corrosion. The complete equipment is designed to operate in ambient temperatures up to 131° Fahrenheit (55° centigrade), and down to -40° Fahrenheit (-40° centigrade). When locating the units, there must be free air circulation around them. This requirement is especially important in locating the Transmitter-Converter, as the heat developed within this unit is much greater than that in the other units. In installations where air circulation around a unit is inadequate, air ducts or a circulating fan should be provided.

2. MOUNTING TRANSMITTER-CONVERTER RT-15/APS-15, JUNCTION BOX J-15/APS-15, AND ANTENNA ASSEMBLY AS-18A/APS.

These units are assembled on a specially constructed mounting base. The entire assembly is located in a turret in the belly of the aircraft, and is mounted so that the reflector may normally rotate in a horizontal plane and have an unobstructed view of the earth's surface beneath and around the aircraft. Before mounting these units in the aircraft, assemble them on the special mounting base supplied by the Navy Department. A diagram showing the completed assembly, with a list of the parts supplied, is given in figure 1. Follow this diagram

closely with the step-by-step assembly instructions given below.

a. Drill the round, wooden mounting base as shown in the dimensional drawing, figure 2.

b. Mount the shock-mount assemblies, items 1 and 2, as shown in figure 1. Make sure that the 200 PH-20 sections of the shock-mount assemblies are on the bottom of the board. The placement of the top sections of the shock-mount assemblies is important, since the top section (200 PH-45) of the 358-5005 assembly must be diagonally across from the Junction Box on the Transmitter-Converter. The other top sections are 200-PH-35.

c. Secure each shock-mount assembly to the board placed between the shock-mount sections, with four 1/4-inch bolts, nuts, and lockwashers. These items are supplied by the Navy Department.

d. Place a ground strap over the stud of the top section of each shock-mount assembly; then place a large washer, item 3A, over each strap as shown in figures 1 and 2. Mount the drilled, square, wooden base, furnished by the Navy Department, over these four washers. Secure the base to the four shock-mount studs with washers, lockwashers, and hexagon nuts, items 3, 4, and 5.

e. Attach the metal mounting assembly, used for supporting the Antenna Assembly, to the lower sections of the shock mounts, with ground straps between the shock mounts and mounting assembly as shown. The mounting assembly is supplied by the Navy Department. Secure the mounting assembly at all four shock mounts with washers and elastic stop nuts, items 5 and 6.

f. Place the Transmitter-Converter in the position shown in figure 1. Secure this unit to the brackets located at the corners of the wooden mounting base, with split washers and screws, items 7 and 8, fastening the loose ends of the ground straps at these points.

g. Secure the Junction Box mounting bracket, item 9, to the Transmitter-Converter with the three machine screws, item 10.

h. Fasten the Junction Box, item 11, to the mounting bracket, item 9, with four machine screws, item 12.

i. Lift the Antenna Assembly into place, align the six threaded holes in the base of the

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Antenna Assembly with those in the flat mounting base. Secure the assembly to the mounting base with six cap screws and lockwashers, items 13, 14, and 15. Be sure that the short cap screw, item 13, is in the position indicated in figure 1.

j. Fit together the two r-f transmission-line sections, items 16 and 17, inserting a rubber gasket, item 19, between the sections. Loosely fasten the two sections with four split washers and Allen cap screws, items 18 and 20.

k. Install the r-f transmission-line assembly, composed of items 16 and 17, between the Transmitter-Converter and the Antenna Assembly with split washers and Allen cap screws, items 18 and 20, as shown. Couple the transmission-line assembly to each unit, inserting a rubber gasket, item 19, at each joint. Tighten all three junctions evenly, being careful not to bind any junction.

l. Fasten the loose ends of the lower ground straps to the large metal frame supplied by the Navy Department, by securing each strap to one of the bolts holding this frame to the round, wooden mounting base.

m. Connect the cable plugs to their respective receptacles.

n. Detailed instructions for mounting the complete assembly in the aircraft will be furnished by the Navy Department.

3. MOUNTING TORQUE AMPLIFIER AM-19/APA-14.

The Torque Amplifier should be placed near the Antenna Assembly in order to keep the cables as short as possible. Sufficient clearance should be allowed to permit removal of the unit from its shock-mounted base for servicing or adjustment. Refer to figure 3 for installation details and proceed as follows:

a. Locate and drill the four holes in the aircraft structure at the points indicated in the figure.

b. Place the Torque Amplifier in position and secure it to the supporting surface with the bolts, nuts, and lockwashers supplied.

4. MOUNTING JUNCTION BOX J-35/APA-14 (TORQUE AMPLIFIER).

Since this unit contains no operating controls, it may be located on the aircraft at any convenient point between the Rotary Converter (flux-gate power) and Torque Amplifier. It must have ample clearance for the removal of cables. Instead of

being shock-mounted, the box is fastened rigidly to the aircraft structure. Refer to figure 4 for installation details and proceed as follows:

a. Drill the four $\frac{3}{16}$ -inch holes in the aircraft structure as indicated.

b. Place the unit in position and secure it to the aircraft structure with the four screws, nuts, and lockwashers supplied with the equipment.

5. MOUNTING RECEIVER-INDICATOR R-16/APS-15.

The Receiver-Indicator should be mounted with the front panel in such a position that the operator can conveniently view the indicator screen through the visor, and adjust the controls. The unit is mounted on a base which permits the panel to slope backward at an angle of 35° . In installations where there is extreme vibration, a clearance of one inch should be allowed around the unit. When locating the Receiver-Indicator, space must be reserved adjacent to it for the Control Unit and Computer; see figure 7. The operator must be able to adjust the controls on these units, and at the same time see the indicator screens on the Receiver-Indicator panel. Refer to figure 5 for installation details and proceed as follows:

a. Drill the holes in the aircraft structure for the shock mounts of the Receiver-Indicator Mounting Base MT-132/APS-2, as indicated in figure 5, "Detail of Foot".

b. After cleaning surfaces, fasten the shock mounts to the supporting structure with the $\frac{1}{4}$ -inch bolts, lockwashers, and nuts supplied, making the proper ground-strap connection. The rear mounting pins, the thumb-nut locking devices of the Mounting Base, and the ground straps will effectively ground the Receiver-Indicator, thus providing safety and minimum interference with other equipment.

c. Slide the Receiver-Indicator onto the base and lock it in position with the thumb-nut locking devices.

d. Attach the leather visor to the indicator bezel.

6. MOUNTING RANGE UNIT CP-5/APS-15 OR CP-5A/APS-15.

Although this unit contains no operating controls, it should be accessible for emergency adjustments during flight. The neon bulb on the front, which is used for calibrating purposes, must be clearly visible from the operator's position. Sufficient clearance should be allowed in front to permit re-

removal of the unit from the Mounting Base for servicing. Refer to figure 6 for installation details, and proceed as follows:

a. Drill the .196-inch holes in the aircraft structure for the shock mounts of the Range Unit Mounting Base ★MT-51/UR as indicated.

b. After cleaning surfaces fasten the shock mounts to the supporting structure with the bolts, nuts, and lockwashers supplied.

c. Slide the Range Unit onto the Mounting Base, and lock it in position with the thumb-nut locking devices.

7. MOUNTING CONTROL UNIT C-33A/APS-15 AND COMPUTER CP-3/APS-15.

These units are mounted side by side on a single metal Mounting Base. Instead of being shock-mounted, this base is fastened rigidly to the aircraft structure. Since these units contain a number of operating controls, they should be placed adjacent to the Receiver-Indicator, and convenient to the operator. The units should be mounted so that the operator can easily view the Computer scale and manipulate the controls. Allow clearance around the units as indicated in figure 7, so that the Computer drum and interconnecting cables can be removed. The Navy Department supplies the hardware and mounting instructions for attaching Mounting Base MT-123/APS-15 to the aircraft structure. Refer to figure 7 for installation details, and proceed as follows:

a. Place the Computer and the Control Unit in position on the Mounting Base as shown.

b. Secure each unit to the Mounting Base with the four snapslide fasteners.

8. MOUNTING PLAN REPEATER INDICATOR ID-30/APS-2D.

The Plan Repeater Indicator should be located near the pilot so that he may conveniently adjust the unit and view the screen with the visor attached. Place the unit so that direct light will not fall on the screen. The Plan Repeater Indicator is shipped from the factory with the Mounting Base attached, and is wired for mounting with the base down. In some installations it may be necessary to mount the unit with the base up. In this case the wiring of plug P-501 (cable "D-1") must be changed as follows:

a. Disassemble plug P-501.

b. Reverse cable wires to pins A and B.

c. Reverse cable wires to pins K and L.

d. Reassemble plug P-501.

NOTE

Re-place the indicator dial with the 0° line at the top in the new position, or 180° away from its original position.

A metal plate, with studs for supporting the Mounting Base, is supplied by the Navy Department: install it as directed. A dimensional drawing of the Plan Repeater Indicator ID-30/APS-2D and Mounting Base MT-95/APS-3 is given in figure 8. Fasten the Mounting Base to the metal plate with the snapslide fasteners, and secure the fasteners with locking wire after the unit is mounted.

9. MOUNTING MILLIAMMETER TS-116/APS-15 (CRYSTAL-CURRENT METER).

This unit should be located near the Receiver-Indicator so that the operator may conveniently view it when adjusting or operating the equipment. The meter is mounted on a flat, metal mounting base by means of three rubber shock mounts. It may be installed on either a horizontal or a vertical surface by attaching the mounting base to the bottom or the back of the meter case. Refer to figure 9 for installation details, and proceed as follows:

a. Drill the four .149-inch holes in the aircraft structure as indicated in the figure.

b. Place the unit in position, and secure with the four bolts, nuts, and lockwashers supplied.

10. MOUNTING TILT-STABILIZATION ASSEMBLY AN/APA-15.

This Tilt-Stabilization Assembly is designed to operate from a three-phase power source. The major units of this assembly, supplied in kit form, are listed in Table I. The Servo Amplifier and Gyro Torque Unit are fastened to the Mounting Base at the factory. Instructions for mounting Tilt-Stabilization Assembly AN/APA-15 (XN-1) are given in Section IV.

TABLE I
TILT-STABILIZATION ASSEMBLY AN/APA-15

Quantity	Name of Unit	Type Number
1	Servo Amplifier	AM-21/APA-15
1	Gyro Torque Unit	CN-5/APA-15
1	Mounting Base	MT-131/APA-15
1	Rotary Converter (Three Phase)	PU-14/APA-15

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a. SERVO AMPLIFIER AM-21/APA-15, GYRO TORQUE UNIT CN-5/APA-15, AND MOUNTING BASE MT-131/APA-15.—To install these units on the Antenna Assembly, refer to figure 10, and follow the step-by-step procedure outlined below:

(1) Before mounting any of the tilt-stabilization equipment, remove parts from the Antenna Assembly as follows:

(a) Operate the TILT switch to place the reflector in its maximum UP position; then remove the cover from the tilt-rod stop assembly and the felt cover pad from the rotating head.

(b) Remove the cotter pin and round pin which secure the tilt-rod clevis to the tilt ring.

(c) Remove the screws and nuts which hold the tilt arm to the channel, and lift out the tilt arm, tilt rod, and stop assemblies.

(d) Remove the counterweight brace and counterweight from the channel.

(2) Attach the new tilt-rod assembly, item 5, to the tilt ring with the round pin and cotter pin, items 6 and 7. These are the same parts which were used originally with the old tilt rod.

(3) Install the felt pad and dust cover, items 1 and 2, on the rotating head, and secure with three bolts and lockwashers, items 3 and 4, as indicated in figure 10.

(4) Clamp the rubber bellows, item 8, in the position shown. This is the same bellows which was previously removed.

(5) Fasten the support, item 9, to the rotating head with the two screws and lockwashers, items 10, 11, and 12. Make certain that the long screw, item 10, is in the position indicated.

(6) Remove the clamps, item 18, from the brackets, items 16 and 17, by removing the eight screws and split washers, items 19 and 21. Remove the two screws which, during shipment, clamp one of the gear-train arms of the Gyro Torque Unit to the stop lugs.

(7) Loosely fasten the assembly, item 13, to the support, item 9, with two screws and lockwashers, items 14 and 15. Make sure that the brackets, items 16 and 17, are in position against the support arms as indicated.

(8) Replace the clamps, item 18, in the position shown with screws and lockwashers, items 19 and 21. Do not tighten these screws at this time

as it will be necessary to slip the brackets up or down in leveling the assembly.

(9) Loosen the four screws, item 22, which fasten the brackets to the ends of the mounting shelf.

(10) Level the assembly, item 13, with respect to the base of the Antenna Assembly, and securely tighten the 14 screws, items 14, 19, and 22, which hold the assembly in position.

(11) Drill two 1/8-inch holes through the shelf flanges and support brackets, items 16 and 17, at the points indicated in the figure, and drive in the four groov-pins, item 20.

NOTE

The Gyro Torque Unit is supplied with the gear train locked. This means that while the two arms which protrude from the gear box may be moved as a unit, one cannot be moved independently without unlocking the gear train. It is important that these gears remain locked until the equipment is completely installed and ready to operate.

(12) Pull up (toward the Antenna Assembly base) the Gyro Torque Unit arm, to which the tilt rod is to be attached, until it strikes the stop. Next, operate the TILT switch to move the tilt rod up (toward the Antenna Assembly base) until it is stopped by the limit switch.

(13) Screw the jam nut, item 25, and the clevis, item 26, to the tilt rod, as indicated in the figure.

(14) Couple the clevis to the arm of the Gyro Torque Unit with the ground pin and cotter pin, items 27 and 28. When making this connection be sure that the clevis has been run far enough onto the tilt rod so that it does not force the arm on the Gyro Torque Unit away from the stop. Lock the clevis in this position by tightening the jam nut, item 25.

(15) Attach the tilt arm, item 29, to the channel in the position shown, with screws and lockwashers, items 30, 31, 32, and 33.

(16) Connect one end of the linkage assembly, item 34, to the other arm of the Gyro Torque Unit with a special stud and boots nut, items 35 and 36.

(17) Temporarily attach the other end of the linkage assembly to the tilt arm with a special stud and boots nut, items 35 and 36.

(18) Make sure that the linkage assembly is adjusted for the proper length to hold the reflector dish tilted upward at an angle of 20° from the horizontal, and that the dish edge clears the plumbing. Operate the TILT switch to move the reflector dish to its maximum DOWN position, and measure the tilt angle. The reflector should travel approximately the same distance in both directions from the horizontal. If the tilt in the downward direction is not the same as that in the upward direction, compensate for the difference by adjusting the length of the linkage assembly. Tighten the special stud and boots nut.

(19) Install the counterweight, item 37, on the channel with two screws and boots nuts, items 38, 39, and 40, as indicated in the figure.

(20) Attach the counterweight brace, item 41, to the channel with two screws and boots nuts, items 42 and 43.

(21) If the Antenna Assembly uses a low-altitude reflector, secure the brace to the counterweight with one screw and lockwasher, items 44 and 45. This screw and lockwasher were removed from the original counterweight assembly. If the Antenna Assembly uses a high-altitude reflector, use the long fillister-head screw supplied (1W-88833FA22) in place of item 44, inserting the additional round counterweight (248-3385) between the lockwasher and the brace. This extra counterweight is marked "FOR AN/APS-15 WITH BARREL DISH."

(22) Secure with locking wire all drilled-head screws used in mounting this assembly.

(23) Connect the cables to their proper receptacles as shown in figure 21.

(24) Remove the cover from the tilt-potentiometer housing, and reverse the leads to the outer contacts of the potentiometer. This change is necessary in order to make the tilt meter indicate correctly.

b. ROTARY CONVERTER PU-14/APA-15.—This unit should be mounted in or near the radar compartment, and sufficient clearance allowed for the cable. Refer to figure 11 for installation details, and proceed as follows:

(1) Drill the four .190-inch holes in the aircraft structure as indicated in the figure.

(2) Place the converter in position, and secure it rigidly to the mounting structure with the four

bolts, nuts, and lockwashers supplied for this purpose.

11. MOUNTING INVERTER PE-218-C AND SWITCH BOX BC-1228 (FOR AAF USE ONLY).

Inverter PE-218-C (on Mounting Base FT-398) should be mounted near the main power bus of the aircraft. Sufficient clearance must be allowed around the unit to permit adequate ventilation. The Switch Box BC-1228 should be mounted in the radar compartment in a location convenient to the operator. See figure 14 for installation details of Switch Box BC-1228. Figure 18 shows the Inverter and Switch Box correctly connected through cable "H" to the Receiver-Indicator.

12. CABLE CONSTRUCTION.

a. CABLES REQUIRED.—The Model AN/APS-15 Radar Equipment requires 38 cables. The cables are identified by letters "A", "B", "C", "AA", "AB", etc., printed on the bodies of the connectors.

(1) Sixteen cables ("D-1", "E-1", "I", "J", "K", "L", "M", "M-1", "N", "P", "S", "T", "AN", "AO", "AV", and "AW") are made to the required length and shipped attached to the equipment.

(2) The 22 remaining cables ("A", "B", "C", "D", "E", "G", "H", "AA", "AB", "AC", "AD", "AE", "AF", "AG", "AH", "AJ", "AK", "AM", "AP", "AR", "AU", and "AX") must be constructed when the equipment is installed.

b. CABLE-ASSEMBLY DETAILS.—Constructional details for the assembly of each of these cables are given in figure 20. Materials for constructing the cables are supplied in bulk.

The required lengths of the cables of the various units should be determined after the units are located. In determining the required lengths, observe the following requirements:

(1) Avoid sharp bends. The minimum bending radius for each cable is given in figure 20.

(2) Allow sufficient cable length for the connectors to be easily removed from the units, and the units easily dismounted for servicing.

(3) As cable conduit stretches when pulled, the cable wires must be cut long enough to provide

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slack when the conduit is pulled to maximum length; this precaution is necessary to prevent strain at the plug pins.

(4) After meeting the above requirements, make the cables as short as possible.

c. SPECIAL CABLE-ASSEMBLY TOOLS REQUIRED.—To assemble the cables according to the detailed instructions given in figure 20, the following equipment supplied by American Phenolic Corporation, Cicero Post Office, Chicago, Illinois (or equivalent) is required:

(1) Three flexible conduit saw-vises:

(a) Amphenol No. 9749-1 (for $\frac{3}{16}$ -inch, $\frac{1}{2}$ -inch, and $\frac{3}{8}$ -inch conduit).

(b) Amphenol No. 9749-2 (for $\frac{1}{2}$ -inch and $\frac{5}{8}$ -inch conduit).

(c) Amphenol No. 9749-3 (for $\frac{3}{4}$ -inch conduit).

(2) Amphenol ferrule crimping machine model "A", swaging tools for attaching ferrules to cables, including 8 mandrels and 2 split collets. Complete instructions for operating the equipment are supplied by the manufacturer with each tool.

d. CABLE TESTS.—After the cables have been completely assembled, they should be tested for continuity and breakdown as follows:

(1) Check for continuity between corresponding terminals of the plugs at both ends of the cable, and between connector-plug shells and shield.

(2) Using 600 volts r.m.s. a. c., there should be no breakdown when checking each terminal on all cable connectors (with the exception of cable "E") to the connector body, and to all other terminals.

(3) Using 5000 volts d. c.; (or 3500 volts r.m.s., a. c.), there should be no breakdown when checking between the pin and the connector body of cable "E"

13. CONNECTING CABLES TO UNITS.

CAUTION

DO NOT ATTACH ANY CABLE TO ANY UNIT BEFORE MAKING CERTAIN THAT THE "POWER" SWITCH ON THE RECEIVER-INDICATOR IS IN THE "OFF" POSITION.

a. CHECKING CONNECTIONS AND FASTENING PLUGS TO RECEPTACLES.—Check each cable according to figure 21, before connecting, to be sure that the markings on the plugs agree with those on the units.

(1) Make sure that the key positions on the plugs are properly located.

(2) Connect the correct plugs (male or female) to their receptacles, and securely tighten the locking rings by hand.

b. GROUNDING CABLES.—All units of the equipment are grounded to the aircraft structure through the ground straps at the shock mounts, or by the mounting bolts. The interconnecting cables are enclosed in flexible, metal conduits. These conduits are grounded at each unit through the locking rings.

(1) Bond the flexible, metal conduit of each cable to the aircraft structure at several points.

(2) If the conduit touches metal at any unbonded point, insulate the conduit at this point with friction tape or any other suitable insulating material.

14. POWER SOURCE AND FUSE REQUIREMENTS.

NOTE

The power source is not supplied with the Model AN/APS-15 equipment. Instructions for making power-supply connections are separately supplied by the proper authorities.

a. POWER SOURCE.—Power is supplied to the equipment through two cables "H" and "AR". Cable "H" is the main source of supply; it feeds both a-c and d-c power to the Receiver-Indicator; from this unit power is distributed to other units. Cable "AR" feeds d-c power to the Control Unit; from this unit power is supplied to the tilt-stabilization Rotary Converter.

(1) The five conductors of cable "H" are connected as follows:

Terminal A: To starting-circuit relay for motor-generator power source. This terminal is not used with engine-driven generators.

Terminal B: To 115-volt, 400 to 2400-cycle, a-c supply.

Terminal C: To negative (—), 24-volt, d-c supply.

Terminal D: To positive (+), 24-volt, d-c supply.

Terminal E: To 115-volt, 400 to 2400-cycle, a-c supply.

(2) The two conductors of cable "AR" are connected as follows:

Terminal A: To negative (-), 24-volt, d-c supply.

Terminal B: To positive (+), 24-volt, d-c supply.

b. FUSES.—The power-supply circuits of the equipment are protected by thirteen fuses, distributed among the various units as follows:

(1) RECEIVER-INDICATOR R-16/APS-15.—The Receiver-Indicator power-supply circuits are protected by two 10-ampere fuses and one 15-ampere fuse located at the lower left-hand corner of the front panel, and three fuses (one 1-ampere and two 3-ampere) located on the rear channel inside the chassis. The 15-ampere fuse is in series with the positive (+) conductor of the 24-volt, d-c power source, and one 10-ampere fuse is in series with each conductor of the 115-volt, 400 to 2400-cycle, a-c power source. One 3-ampere fuse is in series with each primary of transformers T-201 and T-202, and the 1-ampere fuse is in series with the primary of transformer T-203. Spare fuses are provided underneath the Receiver-Indicator Mounting Base, and on the rear channel inside the chassis.

(2) TRANSMITTER-CONVERTER RT-15/APS-15.—The Transmitter-Converter power-supply circuits are protected by one 5-ampere and one 10-ampere fuse located on the right-hand side of the front panel. The 10-ampere fuse is in series with one conductor of the 115-volt, 400 to 2400-cycle, a-c power source to which one leg of every power transformer is connected. The 5-ampere fuse is in series with the other leg of the high-voltage power transformer.

(3) CONTROL UNIT C-33A/APS-15.—The Control Unit power-supply circuits are protected by two 2-ampere fuses and one 20-ampere fuse, located in the upper right-hand corner of the front panel. The 20-ampere fuse is in series with the positive (+) conductor of the 24-volt, d-c power source; it is connected between pin "B" of receptacle "AR" and pin "D" of receptacle "AP". The two 2-ampere fuses are in series with the two ungrounded legs of the three-phase winding of the Rotary Converter; one is connected between pin

"A" of receptacle "AP" and pin "B" of receptacle "AM"; the other is connected between pin "C" of receptacle "AP" and pin "C" of receptacle "AM". A spare 20-ampere fuse is located with the other fuses on the front panel.

(4) RANGE UNIT CP-5/APS-15 OR CP-5A/APS-15.—The Range Unit power-supply circuits are protected by one 5-ampere and one 2-ampere fuse, located at the bottom of the front panel of the unit. The 2-ampere fuse is in series with the positive (+), 24-volt, d-c supply to the blower motor B-401; the 5-ampere fuse is in series with the 115-volt, 400 to 2400-cycle, a-c supply to the power transformer T-401.

15. PRESSURIZING.

After installing the equipment, and before power is applied, both the Transmitter-Converter and the transmission line should be pressurized. Although the pressurizing pump contains a drier unit for reducing the moisture of the air pumped into the unit, pressurizing should be done during the driest part of the day, if possible. The drier element in the pressurizing unit must be replaced before saturation takes place. The replacement time will vary considerably, depending on humidity conditions. The material in the drier element is blue when it is fresh and dry. After exposure to moisture it will turn pink. The element should be replaced before all of the crystals have turned color completely.

a. Connect the pressurizing pump, in turn, to the valve on the front panel of the Transmitter-Converter, and to the valve on either section Z-602 or Z-607 of the transmission line.

b. Raise the internal pressure of the Transmitter-Converter and transmission line to five pounds above sea-level pressure. This pressure must be maintained to prevent voltage breakdown or arc-over at high altitudes.

c. Make daily checks to see that the equipment is properly pressurized. If the pressure drops to less than four pounds within 24 hours, the equipment must be checked for leakage by maintenance personnel.

d. If the equipment is frequently operated at high altitudes, it will probably be necessary to install a motor-driven pump to maintain correct transmission-line pressure.

WARNING

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. PERSONNEL MUST OBSERVE ALL SAFETY PRECAUTIONS AT ALL TIMES.

16. SUPPLY-VOLTAGE PRECAUTIONS.

When checking the equipment, the aircraft batteries should not be used excessively. If prolonged tests are made, an external source of 24 volts d. c., of adequate capacity, should be provided (see Table IV of section I for requirements of source). If the 115-volt, 400 to 2400-cycle, a-c supply is an engine-driven generator (not a motor-generator), it will also be necessary to provide a suitable a-c supply having this voltage and frequency range. THE SYSTEM SHOULD NEVER BE OPERATED FROM ANY A-C SUPPLY WITH FREQUENCY LESS THAN 400 CYCLES. The supply voltages should be accurately measured both before and after placing the system into operation.

NOTE

Before starting the equipment for voltage measurements and pre-flight adjustments, turn all ON-OFF switches to the OFF position. Turn all screwdriver controls on the Receiver-Indicator panel, except the "A" SCOPE CENTERING, HOR. and VER., and the "PPI" CENTERING, HOR. and VER. controls to the counter-clockwise position.

17. ADJUSTING RECEIVER-INDICATOR R-16/APS-15 AND PLAN REPEATER INDICATOR ID-30/APS-2D.

- a. Throw the POWER switch to the ON position.
- b. Throw the spinner SPEED switch to the LO position.
- c. Throw the spinner OFF-ON switch to the ON position.
- d. After waiting one full minute, turn the BRILL. VERNIER, LOCAL and REMOTE controls clockwise until the sweep line just appears on the PPI screen.
- e. Adjust the PPI FOCUS, LOCAL and the FOCUS control on the PRI until the sweeps are focused to sharp lines. Since the focus and bril-

liance controls interlock to some extent, the operator must adjust these controls alternately to obtain the best combination of brilliance and focus of the sweep lines.

f. If the PPI sweep line does not start from the center of the screen, adjust the "PPI" CENTERING, HOR. and VER. controls until the sweep line starts from the center of the screen.

g. Turn the "A" SCOPE, BRILL. control in a clockwise direction, until the horizontal sweep line is visible on the "A" scope screen.

h. Turn the "A" SCOPE, FOCUS control until the sweep line on the "A" scope is adjusted to a sharp line. Since the "A" scope focus and brilliance controls interlock to some extent, they must be adjusted and checked together.

i. If the "A" scope sweep line is not centered on the screen, its horizontal and vertical positions are changed independently by means of the "A" SCOPE CENTERING, HOR. and VER. controls.

j. Turn the VIDEO GAIN knob clockwise to about half-way setting, and adjust the RECEIVER GAIN knob until noise indications appear on the "A" scope.

k. Turn the RANGE MARKS control clockwise until range marks appear on the sweep line.

l. Turn the SWEEP AMPLITUDE controls clockwise until the correct number of range marks are seen, according to the following list. In each case, the outermost range mark should be set just inside the outer edge of the PPI screen.

Position of RANGE SWITCH	Number of Range Marks
First	5
Second	4
Third	5
Fourth	5

18. ADJUSTING TRANSMITTER-CONVERTER RT-15/APS-15.

- a. Throw the TRANS. FIL. switch to the ON position.
- b. After waiting five minutes hold the TRANS. H.V. switch to the START position for a moment, and then release.

c. Turn the "A" SCOPE SWITCH to position 2. The pulse from the transmitter should appear on the "A" scope.

d. Return the "A" SCOPE SWITCH to position 1. Vary the OSCILLATOR TUNING control for maximum signal indications on the "A" scope. Make sure that the crystal-current MILLIAMMETER indicates 0.4 to 0.6 millamperes.

e. Throw the TRANS. CURRENT switch to the MOD. position. The TRANS. CURRENT meter should read the value specified by the sticker on the meter face.

f. Throw the TRANS. CURRENT switch to the RCT. position. The TRANS. CURRENT meter should read about two to four milliamperes more than the value marked on the meter face. If the correct values are not obtained, the equipment should be adjusted by maintenance personnel.

19. ADJUSTING RANGE UNIT CP-5/APS-15 OR CP-5A/APS-15 (ADJUSTING 10:1 DIVIDER).

a. Turn USE-RNG-ALT control to USE position.

b. Turn "A" SCOPE SWITCH to position 4.

c. Turn RANGE SWITCH on Receiver-Indicator to the second position and observe "A" scope.

d. Count the short pips; nine short pips should appear between two long pips.

e. If either eight or ten short pips occur between the two long pips, adjust control "10" (10:1 frequency divider) through hole in dust cover of Range Unit until count is nine.

f. If counting the pips is difficult, turn RANGE SWITCH to the first position for expanded view of waveform. Turn ALTITUDE control on Computer to bring hair-line indicator to minimum altitude-scale reading. Fewer than 10 pips will now be visible on the "A" scope. With a long pip for reference, turn ALTITUDE control toward high-altitude end of scale, counting short pips as they move across screen until another long pip appears. This should be the 10th pip.

20. ADJUSTING UNITS OF TILT-STABILIZATION ASSEMBLY AN/APA-15.

a. Move the locking lever at the end of the Gyro Torque Unit to the UNLOCK position.

b. Pull or push the antenna reflector to its upward or downward limit of travel.

c. Turn the TILT STAB. switch to the ON position.

d. Wait 10 minutes for the gyro to reach full speed, and throw the TILT GYRO switch to the UNCAGE position. If the equipment is operating normally, the reflector will immediately return to the tilt position indicated by the TILT meter.

e. Turn the screwdriver gain control on the front panel of the Servo Amplifier in a clockwise direction, until the antenna reflector "hunts" or oscillates mechanically; turn the control counterclockwise until the oscillation just ceases.

21. ADJUSTING AZIMUTH-STABILIZATION UNITS.

a. Start the flux-gate gyro-compass system according to the instructions supplied for the operation of this equipment.

b. With the spinner fixed, and the AZ. STAB. switch in the OFF position, loosen the screw in the slot of the HEADING ADJ. arm, and move the arm to its extreme position, first in one direction and then in the other. The sweep line should move slowly around the PPI screen and stop at a new position. Turn the screwdriver gain control on the panel of the Torque Amplifier in a clockwise direction, until correction of the sweep-line position is made at a speed of three degrees per second.

c. Turn the AZ. STAB. switch to the ON position. The lubber line should swing around until its reading on the azimuth scale is the same as that of the master indicator. If the lubber line does not coincide with the master-indicator reading, the equipment should be adjusted by maintenance personnel.

d. Throw the spinner OFF-ON switch to the ON position.

e. Throw the SPEED switch to the HI position.

f. Throw the LUBBER LINE switch to the ON position. The spinner should now be in continuous, fast rotation, and the lubber line should flash on the PPI screen once for each sweep rotation.

g. Throw the AZ. STAB. switch to the OFF position.

h. Adjust the HEADING ADJ. arm of the magnetosyn until the lubber line is coincident with the zero point of the azimuth scale.

i. Tighten the screw in the arm slot.

j. After the lubber line is correctly placed, throw the AZ. STAB. switch ON and OFF several times,

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and check to see that the lubber line returns to the proper position. If it does not, the equipment should be adjusted by maintenance personnel.

22. CHECKING ANTENNA ASSEMBLY.

Before starting these checks, turn OFF all antenna controls.

a. Throw the spinner SPEED switch to the HI position.

b. Throw the spinner OFF-ON switch to the ON position. Check the direction and speed of spinner rotation; when the Antenna Assembly is viewed from a position in the aircraft, the spinner should rotate clockwise at a speed of about 24 r.p.m. Count for one minute to see that the speed is approximately correct. The direction of rotation of the spinner may be determined by observing the rotation of the PPI sweep, which should be clockwise.

NOTE

The rotation of the PPI sweep may be counterclockwise unless, after sector scan

was last used, the SECTOR SCAN switch was turned OFF before the spinner OFF-ON switch was turned OFF. To correct the direction of sweep rotation, with the spinner OFF-ON switch ON, turn the SECTOR SCAN switch first to the ON position, and then to the OFF position.

c. Throw spinner SPEED switch to LO position; check for correct speed of spinner rotation, approximately 12 r.p.m.

d. Throw spinner OFF-ON switch to OFF position.

e. Press MANUAL switch to R; sweep should rotate clockwise.

f. Press MANUAL switch to L; sweep should rotate counterclockwise.

g. Set sweep of PPI with MANUAL control, and check corresponding azimuth position of spinner at following points: 0°, dead ahead; 90°, exact right; 180°, dead astern; and 270°, exact left.

h. Turn equipment OFF.

SECTION III OPERATION

1. LOCATION OF OPERATING CONTROLS.

All operating controls are located on the panels of the Receiver-Indicator, Control Unit, Computer, and PRI. Most of the screwdriver controls are pre-set by maintenance personnel, and require no adjustment during operation of the equipment.

2. PRE-FLIGHT INSPECTIONS.

Before the equipment is put into operation, it should be inspected by maintenance personnel. Cable-plug and ground-strap connections, power-source voltages, air pressure of pressurized units, blower motors, and antenna action should be checked. A pre-flight check of control adjustments should be made as outlined in section II, paragraphs 15 through 22.

3. STARTING EQUIPMENT AND CHECKING OPERATING CONDITION.

NOTE

BEFORE EQUIPMENT IS STARTED, ALL "OFF-ON" SWITCHES SHOULD BE IN "OFF" POSITION. "OPEN CENTER" KNOB CONTROL, AND "BRILL. VERNIER", "LOCAL" AND "REMOTE" CONTROLS SHOULD BE IN COUNTERCLOCKWISE POSITION.

a. Throw POWER switch to ON position. (In Army installations, also push button on Switch Box BC-1228.)

b. Throw TRANS. FIL. switch to ON position.

c. Check reading of VOLTAGE MONITOR meter.

CAUTION

DO NOT OPERATE EQUIPMENT WHEN A-C POWER-SOURCE VOLTAGE IS BELOW 112 VOLTS OR ABOVE 118 VOLTS. IF VOLTAGE IS NOT WITHIN THESE LIMITS, CONSULT MAINTENANCE PERSONNEL.

d. Throw "A" SCOPE SWITCH to position 1.

e. After sweep line appears on "A" scope, turn BRILL. VERNIER, LOCAL AND REMOTE con-

trols clockwise until sweep line is barely visible on PPI and PRI.

f. After waiting five minutes, hold TRANS. H.V. switch to START position for a moment, and then release.

g. Throw TRANS. CURRENT switch to MOD. position, and check TRANS. CURRENT meter reading for value specified on meter sticker.

h. Throw TRANS. CURRENT switch to RCT. position, and check TRANS. CURRENT meter reading for value specified on meter sticker plus two to four milliamperes.

i. Throw TILT STAB. switch to ON position.

j. After waiting 10 minutes, throw TILT GYRO switch to UNCAGE position.

k. Throw spinner SPEED switch to LO position.

l. Throw spinner OFF-ON switch to ON position.

m. Throw RANGE UNIT switch on Receiver-Indicator to ON position.

n. Check to make sure that USE-RNG-ALT switch on Range Unit is in USE position.

o. Throw SRCH.-BEA. switch to SRCH. position, and A.F.C.-MAN. switch to A.F.C. position.

p. Turn VIDEO GAIN control to about half-way setting, and adjust RECEIVER GAIN control until noise indication on "A" scope is 1/4-inch high.

q. Throw A.F.C.-MAN. switch to MAN. position.

r. Adjust OSCILLATOR TUNING control for maximum signal indications on "A" scope. The crystal-current MILLIAMMETER should indicate 0.4 to 0.6 milliamperes.

s. Throw A.F.C.-MAN. switch to A.F.C. position.

t. Check amplitude of signal indications. If amplitudes are not approximately the same in both A.F.C. and MAN. positions, the equipment should be adjusted by maintenance personnel.

u. Turn "A" SCOPE SWITCH to position 2. The transmitter pattern should appear on the "A" scope.

v. Turn "A" SCOPE SWITCH to position 3. The a-f-c pattern should appear on the "A" scope.

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w. Turn "A" SCOPE SWITCH to position 4, and RANGE SWITCH on Receiver-Indicator to second position. Nine short pips should lie between two long pips. If counting the pips is difficult, due to aircraft vibration, the pattern may be expanded by turning the RANGE SWITCH on the Receiver-Indicator to the first position. In this position it will be necessary to rotate the ALTITUDE control to cause the pips to move slowly across the face of the "A" scope for counting.

4. STOPPING EQUIPMENT.

- a. Throw RANGE UNIT switch on Receiver-Indicator to OFF position.
- b. Throw spinner OFF-ON switch to OFF position.
- c. Throw TILT GYRO switch to CAGE position.
- d. Throw TILT STAB. switch to OFF position.
- e. Throw TRANS. FIL. switch to OFF position.
- f. Throw POWER switch to OFF position.

SECTION IV
SUPPLEMENTARY DATA

1. TILT-STABILIZATION ASSEMBLY AN/APA-15(XN-1).

a. GENERAL DESCRIPTION.—The first 30 tilt-stabilization assemblies supplied, AN/APA-15(XN-1), are designed to operate from a single-phase power source. The major units of these assemblies, supplied in kit form, are listed in Table I, with the dimensions, weight, and numerical series of reference symbols for each unit. The Servo Amplifier and the Gyro Torque Unit are fastened to the Mounting Base at the factory.

b. INSTALLATION.

(1) SERVO AMPLIFIER UNIT 1 OF AN/APA-15(XN-1), GYRO TORQUE UNIT, UNIT 2 OF AN/APA-15(XN-1), AND MOUNTING BASE UNIT 3 OF AN/APA-15(XN-1).—The Servo Amplifier and the Gyro Torque Unit are fastened to the Mounting Base at the factory. To install these units on the Antenna Assembly, follow the instructions given in section II, paragraph 10a for the corresponding units of Tilt-Stabilization Assembly AN/APA 15.

TABLE I
MAJOR UNITS OF TILT-STABILIZATION ASSEMBLY AN/APA-15(XN-1)

Quantity	Name of Unit	*Overall Dimensions (inches)			** Weight (lbs.)	Numerical Series of Reference Symbols
		Height	Width	Depth		
1	Servo Amplifier Unit 1 of AN/APA-15(XN-1)	5 $\frac{7}{8}$	4 $\frac{19}{64}$	7 $\frac{1}{8}$	5.9	651-700
1	Gyro Torque Unit Unit 2 of AN/APA-15(XN-1)	7 $\frac{3}{4}$	8 $\frac{3}{4}$	15 $\frac{3}{16}$	13.	651-700
1	‡Mounting Base Unit 3 of AN/APA-15(XN-1)	1 $\frac{7}{8}$	6 $\frac{3}{4}$	20 $\frac{1}{4}$	2.	
2	Rotary Converter (Single Phase) Unit 4 of AN/APA-15(XN-1)	5 $\frac{7}{16}$	3 $\frac{15}{16}$	7 $\frac{5}{16}$	7.75	1501-1600
1	†Junction Box (Tilt Power) Unit 5 of AN/APA-15(XN-1)	2 $\frac{5}{16}$	6 $\frac{7}{16}$	8 $\frac{1}{16}$	††3.75	1601-1700
1	Control Unit Unit 1 of AN/APS-15(XN-1)	5 $\frac{7}{16}$	7 $\frac{15}{16}$	8 $\frac{5}{16}$	4.	901-1000

* Overall dimensions of units do not include Mounting Bases attached.

** Weights of units do not include Mounting Bases attached.

† Overall dimensions include conduit couplings without cables.

†† Weight includes attached cables and plugs.

‡ Without attachments.

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(2) ROTARY CONVERTER UNIT 4 OF AN/APA-15 (XN-1).—The two Rotary Converters should preferably be mounted side by side in or near the radar compartment, with sufficient clearance provided to allow them to rock freely on their shock mounts. Refer to figure 13 for installation details, and proceed as follows:

(a) Locate and drill the four holes for mounting each converter to the aircraft structure, as indicated in the figure.

(b) Secure the units to the supporting structure with the bolts, nuts, snubber washers, and lock washers supplied with the equipment, making the proper ground-strap connections.

(3) JUNCTION BOX UNIT 5 OF AN/APA-15 (XN-1).—This unit, used for paralleling the two single-phase Rotary Converters, should be mounted near these units (within cable-length limits). Refer to figure 12 for installation details, and proceed as follows:

(a) Locate and drill the $\frac{3}{16}$ -inch holes in the aircraft structure at the points indicated.

(b) Fasten the Junction Box to the supporting structure with the bolts, nuts, and lockwashers supplied with the equipment.

(4) CONTROL UNIT, UNIT 1 OF AN/APS-15 (XN-1).—To mount this unit follow the instructions given in section II, paragraph 7 for Control Unit C-33A/APS-15.

c. ADJUSTMENT.—The adjustment of Servo Amplifier Unit 1 of AN/APA-15 (XN-1) and Gyro Torque Unit, Unit 2 of AN/APA-15 (XN-1) is the same as that for corresponding units of Tilt-Stabilization Assembly AN/APA-15. See section II, paragraph 20. Control Unit, Unit 1 of AN/APS-15 (XN-1) contains a magnesyn which must be adjusted in conjunction with azimuth-stabilization units. Refer to section II, paragraph 21 for this adjustment.

SECTION V

EMERGENCY OPERATION AND REPAIR

1. TROUBLE LOCATION.

Although repairs which may be made during flight are limited, a few emergency repairs are possible. In the event of equipment failure during flight, the following checks should be made:

a. Inspect the fuses on the panels of the Transmitter-Converter, Receiver-Indicator, Range Unit, and Control Unit.

b. Check the power-source voltage by observing the reading of the VOLTAGE MONITOR meter on the Receiver-Indicator panel.

c. Inspect cables for loose connections and other defects.

d. Inspect transmission-line joints for loose connections.

e. Inspect ground straps for loose or corroded connections.

f. Check adjustment as directed in section II, paragraph 15 through 22.

2. REPLACING TUBES AND CRYSTALS.

WARNING

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE THE EQUIPMENT WITH HIGH-VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION BUT ALWAYS SHUT DOWN MOTOR GENERATORS OR OTHER POWER EQUIPMENT. UNDER CERTAIN CONDITIONS DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE "OFF" POSITION BECAUSE OF CHARGES RETAINED BY CAPACITORS, ETC. TO AVOID CASUALTIES ALWAYS DISCHARGE AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

a. REPLACING TUBES IN RECEIVER-INDICATOR (EXCEPT PPI AND "A" SCOPE).

(1) Remove all cables from Receiver-Indicator.

(2) Loosen thumb-nut locking device at each lower corner of front panel.

(3) Pull unit from its base by grasping the two handles on the front panel.

(4) Loosen the four fasteners on back of unit by turning each fastener 90° counterclockwise with screwdriver.

(5) Slide cover from unit.

(6) Replace defective tubes.

b. REPLACING "A" SCOPE TUBE.

(1) After cover is removed from Receiver-Indicator according to procedure of paragraph a(1) through (5) above, remove the four screws which hold plate on rear of "A" scope tube shield, and remove plate.

(2) Remove socket from base of tube.

(3) Remove the three screws which hold hood on front panel of Receiver-Indicator, and remove hood and rubber gasket from front of tube.

(4) Push tube through hole in front panel.

(5) Install new tube by reversing procedure of paragraph b(1) through (4) above.

c. REPLACING PLAN POSITION INDICATOR (PPI) TUBE.

(1) After cover is removed from Receiver-Indicator according to procedure of paragraph a(1) through (5) above, remove the four screws from rear cover of housing, and remove cover.

(2) Remove the four screws holding dial assembly, and remove dial assembly, felt ring, and rubber support gasket.

(3) Remove socket from base of tube.

(4) Spread fingers of left hand, and place hand across front of housing for support.

(5) Place tips of thumb and three fingers of right hand around pins of tube base, and gently but firmly push tube base forward, being careful not to squeeze tube pins together. Abnormal resist-

ance to tube movement may be felt after the tube has moved about $\frac{1}{4}$ inch, due to contact between the tube base and the rubber ring supporting the tube at the rear of the housing. Additional pressure on the tube base will be required to force the base through the ring, so that the tube may be withdrawn from the front of the housing by the left hand, rotating the tube about $\frac{3}{4}$ turn to allow the high-voltage lead to slacken.

(6) When front end of tube protrudes through housing two or three inches, remove high-voltage lead which is fastened to curved back side of bulb, and remove tube.

(7) Dust rubber ring at rear of housing with talcum powder to prevent sticking of new tube.

(8) Slip rubber sleeve on neck of tube up to bulb.

(9) Holding front end of tube, insert tube into housing, base end first, taking care that it passes directly through center of the deflection and focus coils.

(10) When front of tube is two or three inches from housing, fasten high-voltage-lead clip to contact cap of bulb, placing clip so that lead will start to wind around bulb.

(11) Continue to insert tube, rotating tube about $\frac{3}{4}$ turn to wind high-voltage lead around bulb, thus removing slack. Abnormal resistance to tube movement may be felt when front of tube protrudes $\frac{1}{2}$ or $\frac{3}{4}$ inch from front of housing, due to contact between tube base and rubber ring supporting tube at rear of housing. By grasping front flanges of housing with fingers of both hands (one hand on each side), tube may be pushed completely into housing by thumb pressure applied to edges of tube face. Proper position of tube face is $\frac{1}{16}$ to $\frac{1}{8}$ inch behind front housing flange.

(12) Replace rubber support gasket, felt ring, and dial assembly, and fasten dial assembly with screws.

(13) Push socket onto base of tube, being sure that leads to socket and terminal strip are clear.

(14) Replace rear cover of housing, and fasten rear cover with screws.

NOTE

After defective tubes of the Receiver-Indicator are replaced, replace the cover, mount the unit on the base, and attach the cables by reversing the procedure of paragraph a(1) through (5) above.

d. REPLACING PLAN REPEATER INDICATOR (PRI) TUBE.—The same procedure for replacing the plan position indicator (PPI) tube, given in paragraph c(1) through (14) above, also generally applies to the Plan Repeater Indicator (PRI) tube, as similar housings are used for both tubes. However, the directions given in c(2) for the removal of the dial assembly must be modified, to read as follows: remove the four screws holding bezel, and remove bezel, felt ring, dial, and rubber support gasket. Also, the directions given in c(12) must be modified to read as follows: replace rubber support gasket, dial, felt ring, and bezel, and fasten bezel with screws. Be sure dial is in correct position.

e. REPLACING TUBES IN TRANSMITTER-CONVERTER.

NOTE

Replacement of tubes in the Transmitter-Converter should be done by maintenance personnel only. If absolutely necessary, the tubes under the dome cover may be replaced without removal of the entire unit by the following procedure:

(1) Remove hexagon nuts and lockwashers around rim of cover.

(2) Remove cover, breaking gasket seal by jarring or prying (DO NOT INJURE GASKET).

(3) Replace tubes.

CAUTION

IF THE TOP ROUND COVER IS REMOVED FROM TRANSMITTER WHEN MAKING REPAIRS OR ADJUSTMENTS IN CLIMATES WHERE THERE IS A LARGE AMOUNT OF MOISTURE IN THE AIR, MAKE SURE ALL SURFACES AND PARTS ARE DRY BEFORE REPLACING COVER. THIS CAN BE DONE BY PLACING THE UNIT IN FRONT OF A HOT-AIR FAN OR OPERATING THE UNIT WITH COVER REMOVED FOR ONE HOUR.

(4) Replace cover, observing position of guide pin, and replace lockwashers and nuts around rim of cover; tighten evenly.

(5) Pressurize unit to five pounds above sea-level pressure by means of a pressurizing pump (unless automatic pressurizing equipment is provided).

f. REPLACING TUBES AND CRYSTAL IN RANGE UNIT.

- (1) Remove all cables from unit.
- (2) Loosen thumb-nut locking device at each lower corner of front panel.
- (3) Pull unit from its base by grasping the two handles on the front panel.
- (4) Loosen fastener on back of unit by turning fastener 90° counterclockwise with screwdriver.
- (5) Slide cover from unit.
- (6) Replace tubes.

NOTE

To replace crystal, loosen knurled nut holding crystal clamp, pull out defective crystal, plug in new crystal, replace clamp, and tighten knurled nut.

- (7) Replace cover, replace unit on base, and attach cables to unit by reversing procedure of paragraph f(1) through (5) above.

g. REPLACING TUBES IN TORQUE AMPLIFIER.

- (1) Remove all cables from unit.
- (2) Remove screws around edges of front panel.

- (3) Slide unit from cover.

- (4) Replace tubes.

- (5) Insert unit into cover, replace screws, and attach cables to unit by reversing procedure of paragraph g(1) through (3) above.

3. REPLACING DIAL-LIGHT BULBS.

a. REPLACING DIAL-LIGHT BULBS IN RECEIVER-INDICATOR.—Four dial-light bulbs are located around the edge of the Receiver-Indicator dial. These bulbs may be replaced simply by unscrewing the old bulbs (in holders), and screwing in new ones. Two spare bulbs are located, with the other four bulbs, on the edge of the dial.

b. REPLACING DIAL-LIGHT BULB IN COMPUTER.

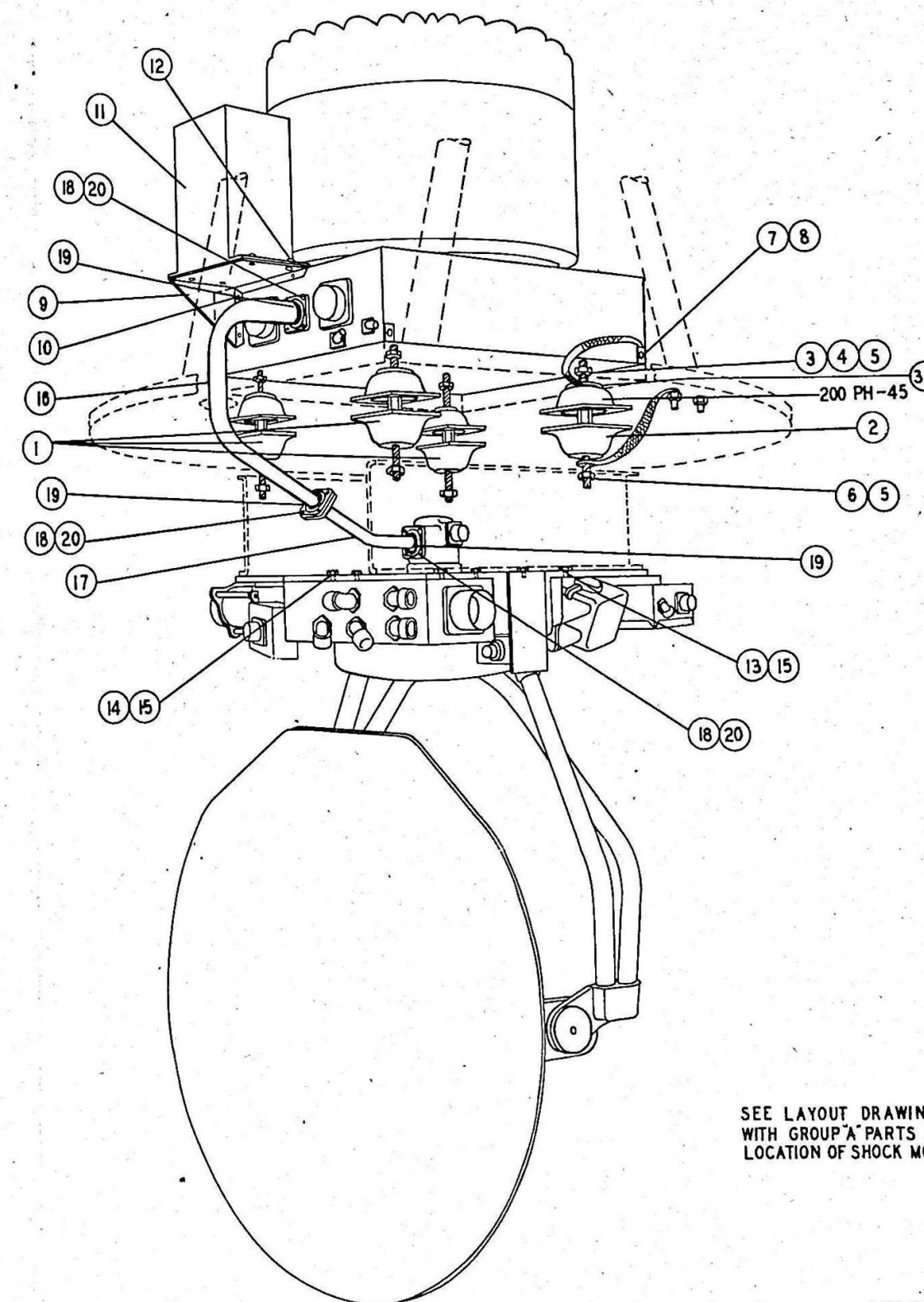
- (1) Remove screws which hold combination top-and-rear cover to unit.
- (2) Replace bulb.
- (3) Replace cover and cover screws.

NOTE

In certain installations, it may be necessary to remove the Computer from its Mounting Base in order to remove the cover. This is done by removing cable "AH", unlocking the snapslide fasteners, and lifting the unit from the base.

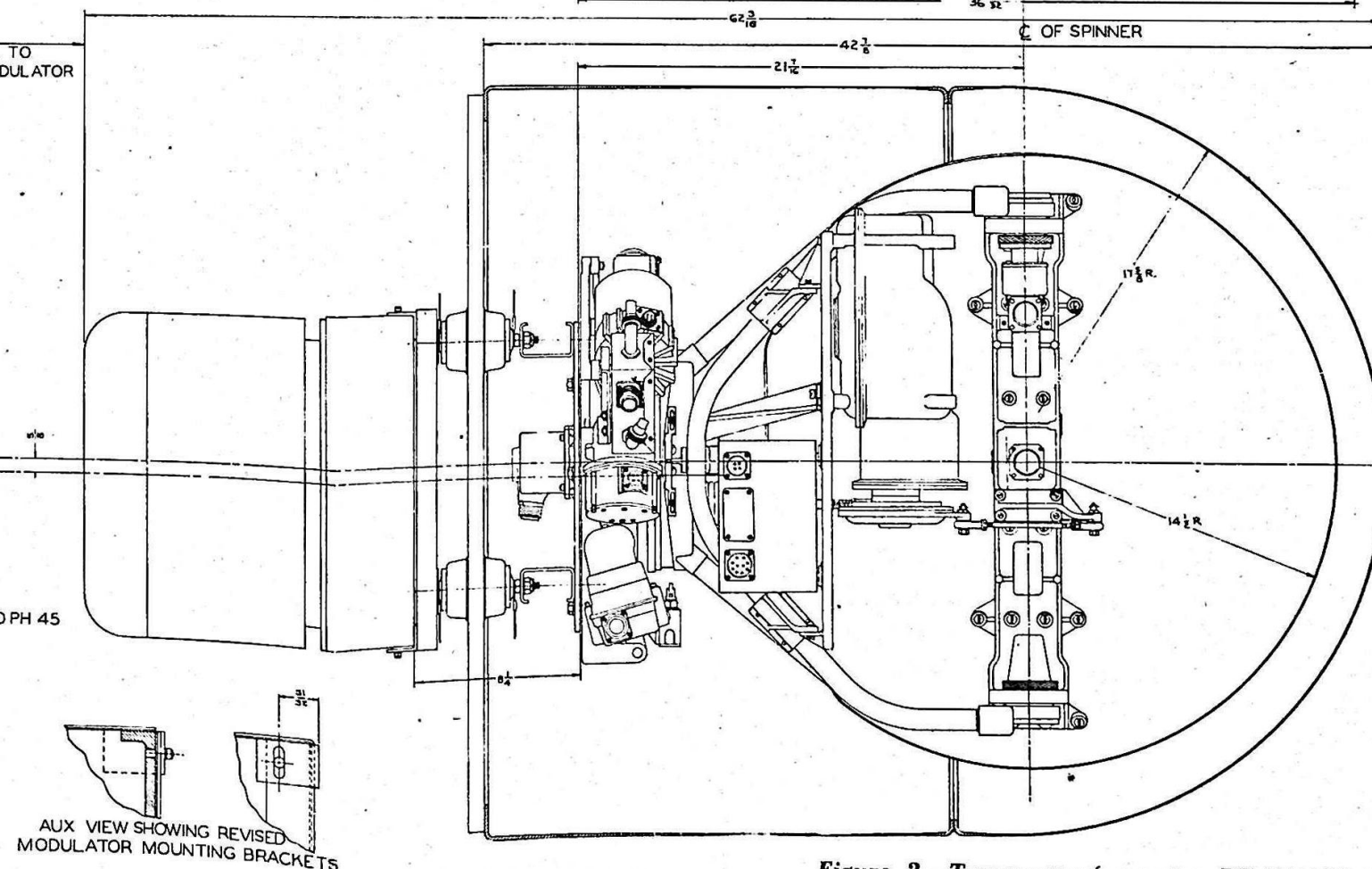
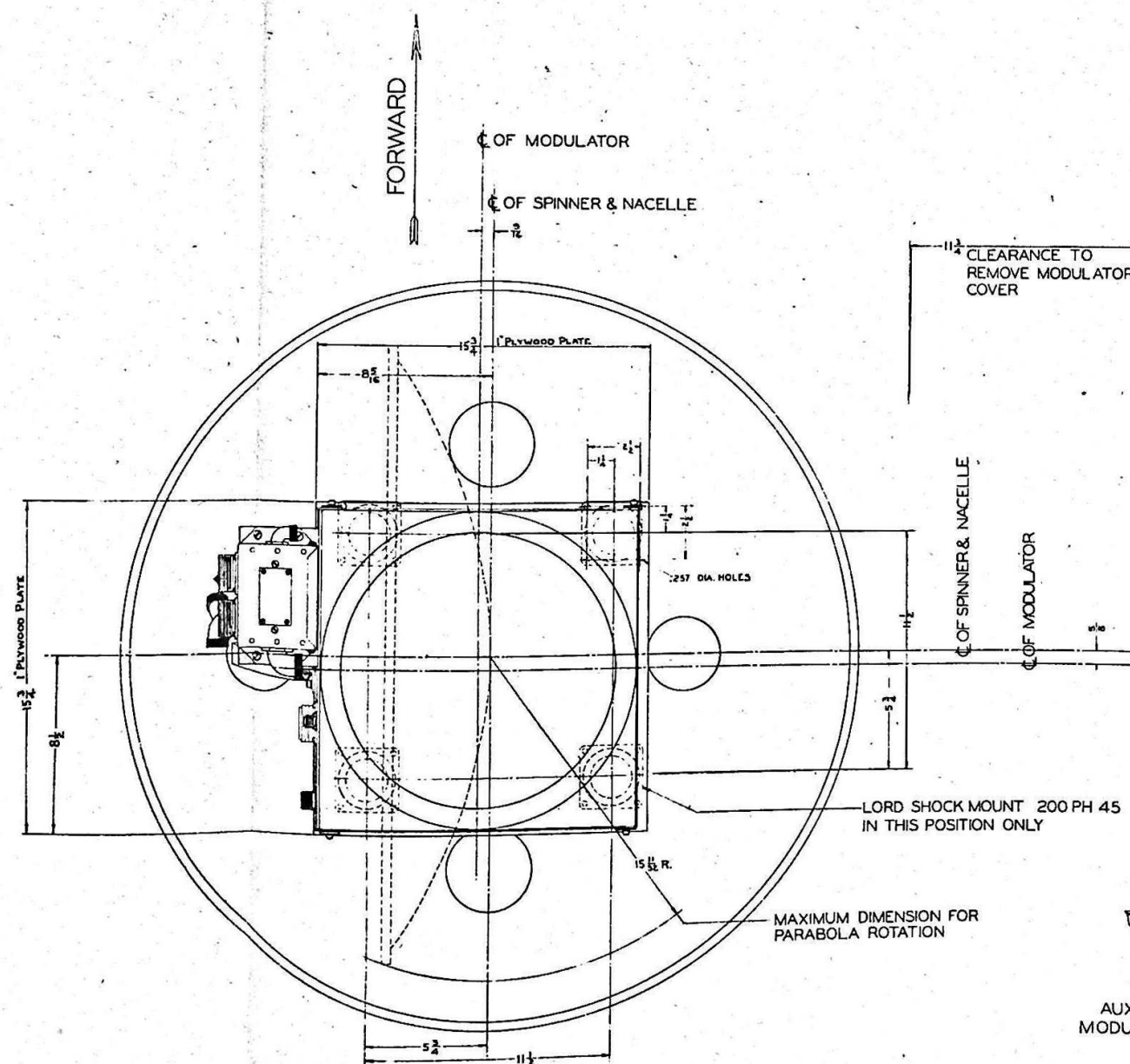
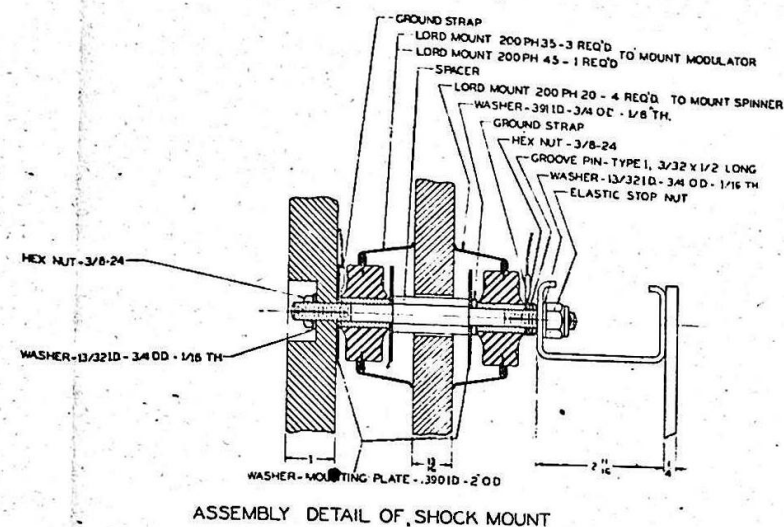
PARTS ILLUSTRATED IN FIGURE

ITEM	PHILCO PART NO.	DESCRIPTION	QTY.	REMARKS
1	358-5004	Shock-mount assembly	3	Refer to layout in Group "A" Parts for mounting positions.
2	358-5005	Shock-mount assembly	1	
3	5W-1902FA22	Washer, 13/32" I.D., 3/4" O.D., 1/16" thick	8	Part of assemblies, items 1 and 2.
3A	258-3038	Washer, 0.390" I.D., 2" O.D.	4	
4	1W-35078FA22	Washer, split, 3/8" standard	4	
5	1W-20760FA22	Hex nut, 3/8"-24	4	
6	1W-42523FA22	Elastic stop nut (59EE064)	4	Mounting transmitter- converter.
7	1W-35049FA22	Washer, split, 1/4" standard	4	
8	1W-16917FA22	Screw, cap, 1/4"-20 x 1/2" long	4	Junction box support.
9	358-5118	Bracket	1	
10	2W-10636FA44	Screw, R.H. machine, 8-32, 1/2" long	3	Mounting item 9.
11	358-7648	Junction Box	1	J-15/APS-15.
12	5W-1839FA22	Screw, R.H. machine, 10-32, 1/2" long	4	Mounting item 11.
13	248-1769	Screw, hex-head cap, 5/16"- 18 x 1-3/8" long	1	Mounting antenna assembly.
14	248-1770	Screw, hex-head cap, 5/16"- 18 x 1-3/4" long	5	
15	1W-35050FA22	Lockwasher, 5/16"	6	
16	348-1488	R-F transmission line, upper section Z-607	1	Mounting r-f transmission line.
17	348-1487	R-F transmission line, lower section Z-606	1	
18	1W-35046FA22	Lockwasher, #18 standard	12	
19	247-1107	Gasket, rubber	3	
20	1W-28222FA22	Screw, socket-head cap, 8-32, 3/8" long	12	



SEE LAYOUT DRAWING SUPPLIED
WITH GROUP "A" PARTS SHOWING
LOCATION OF SHOCK MOUNTS.

Figure 1—Transmitter-Converter RT-15/APS-15,
Junction Box J-15/APS-15, and Antenna
Assembly AS-18A/APS with Other Units,
Assembly Details



**Figure 2—Transmitter-Converter RT-15/APS-15,
Junction Box J-15/APS-15, and Antenna
Assembly AS-18A/APS with Other Units,
Installation Details**

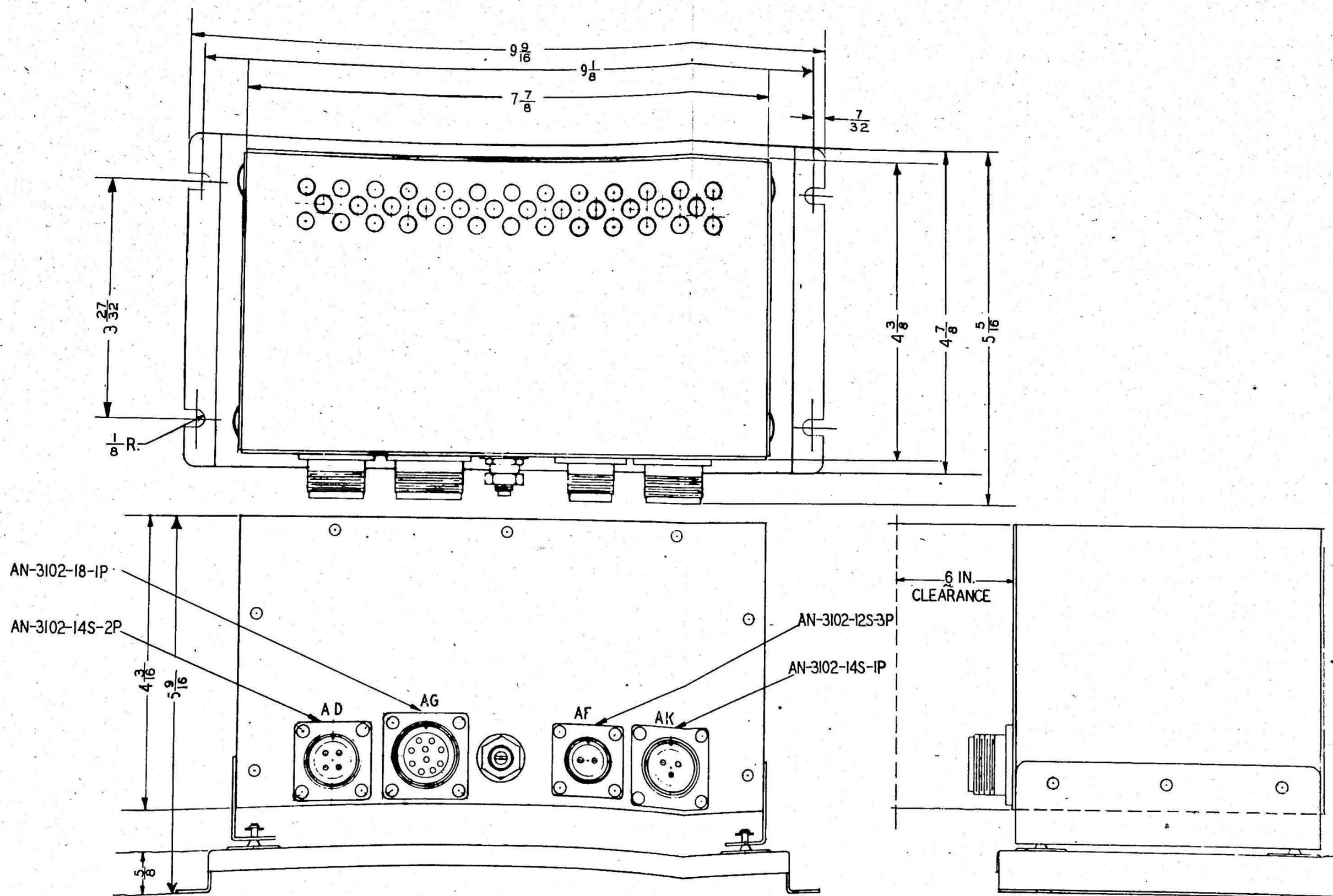


Figure 3—Torque Amplifier AM-19/APA-14,
Installation Details

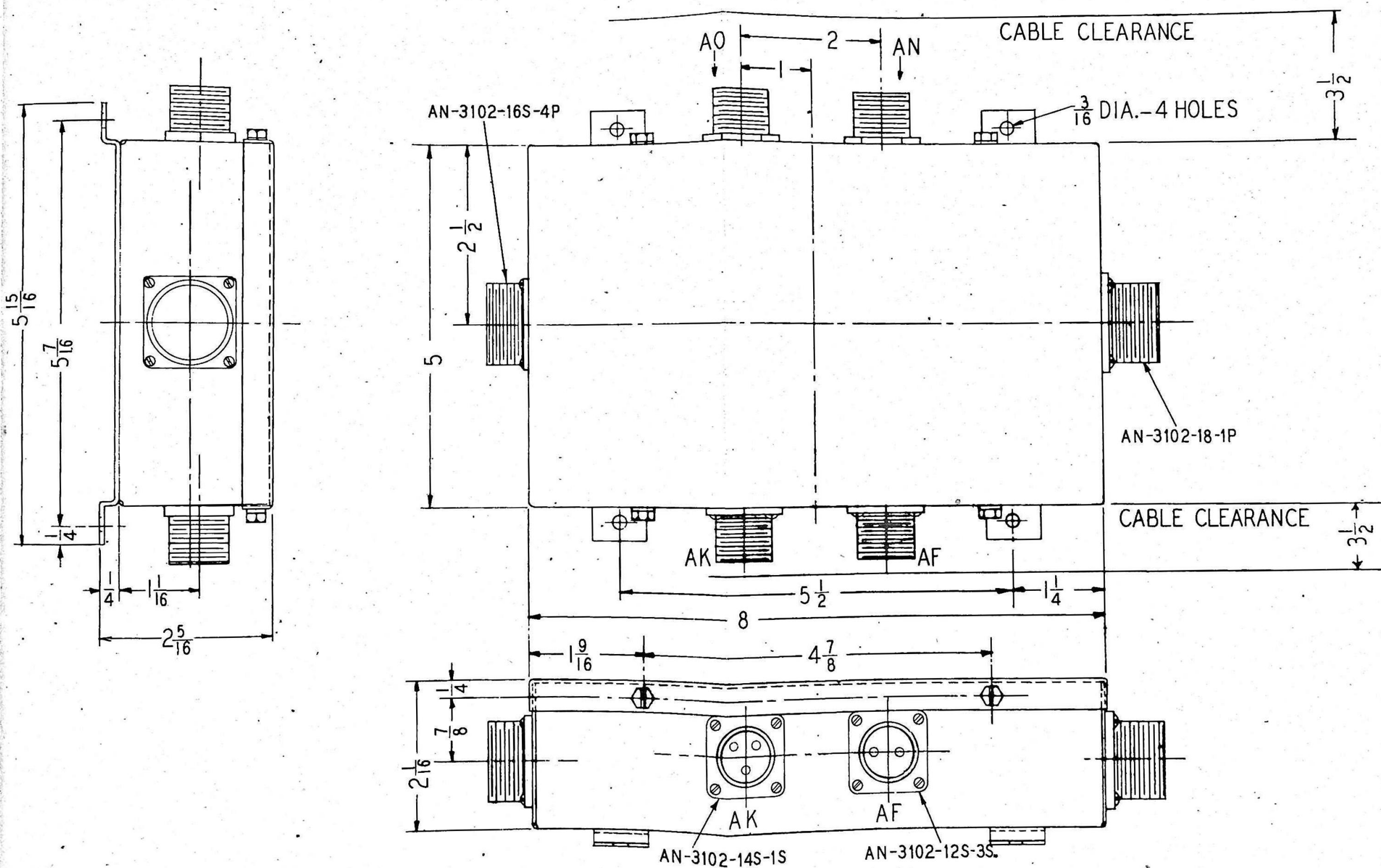


Figure 4—Junction Box J-35/APA-14 (Torque Amplifier), Installation Details

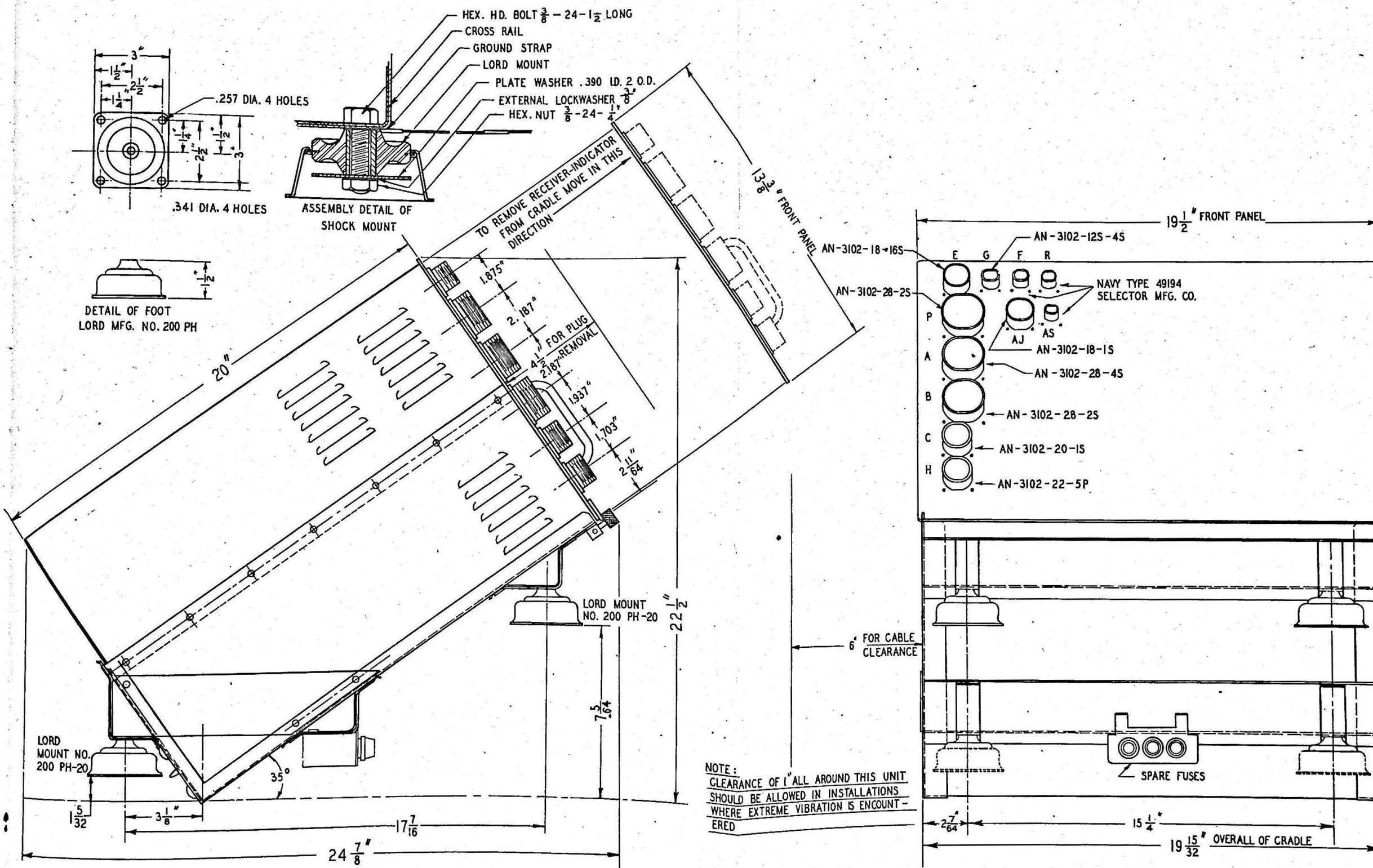


Figure 5—Receiver-Indicator R-16/APS-15 with Mounting Base MT-132/APS-2, Installation Details

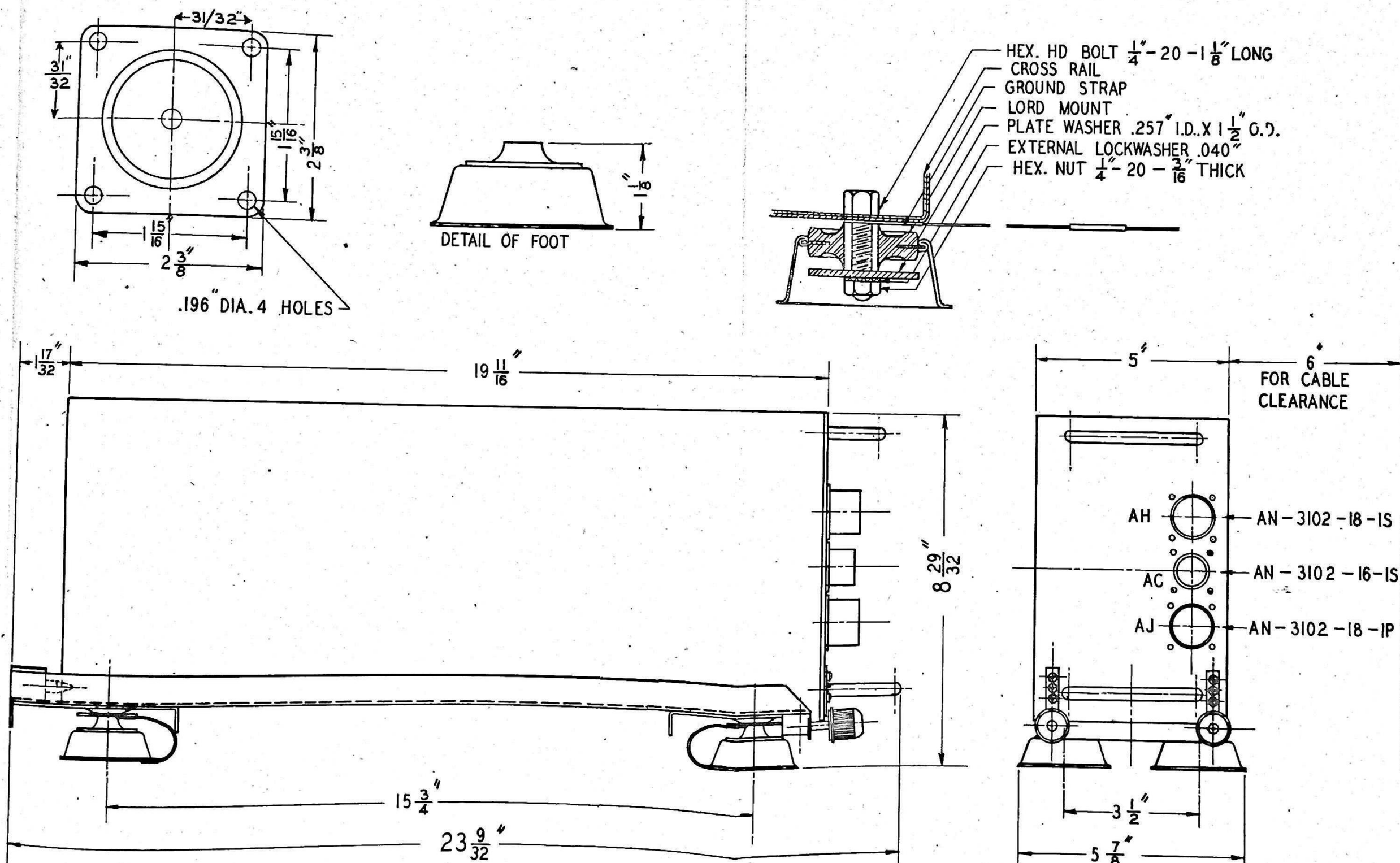


Figure 6—Range Unit CP-5/APS-15 or CP-5A/APS-15 with Mounting Base MT-51/UR, Installation Details

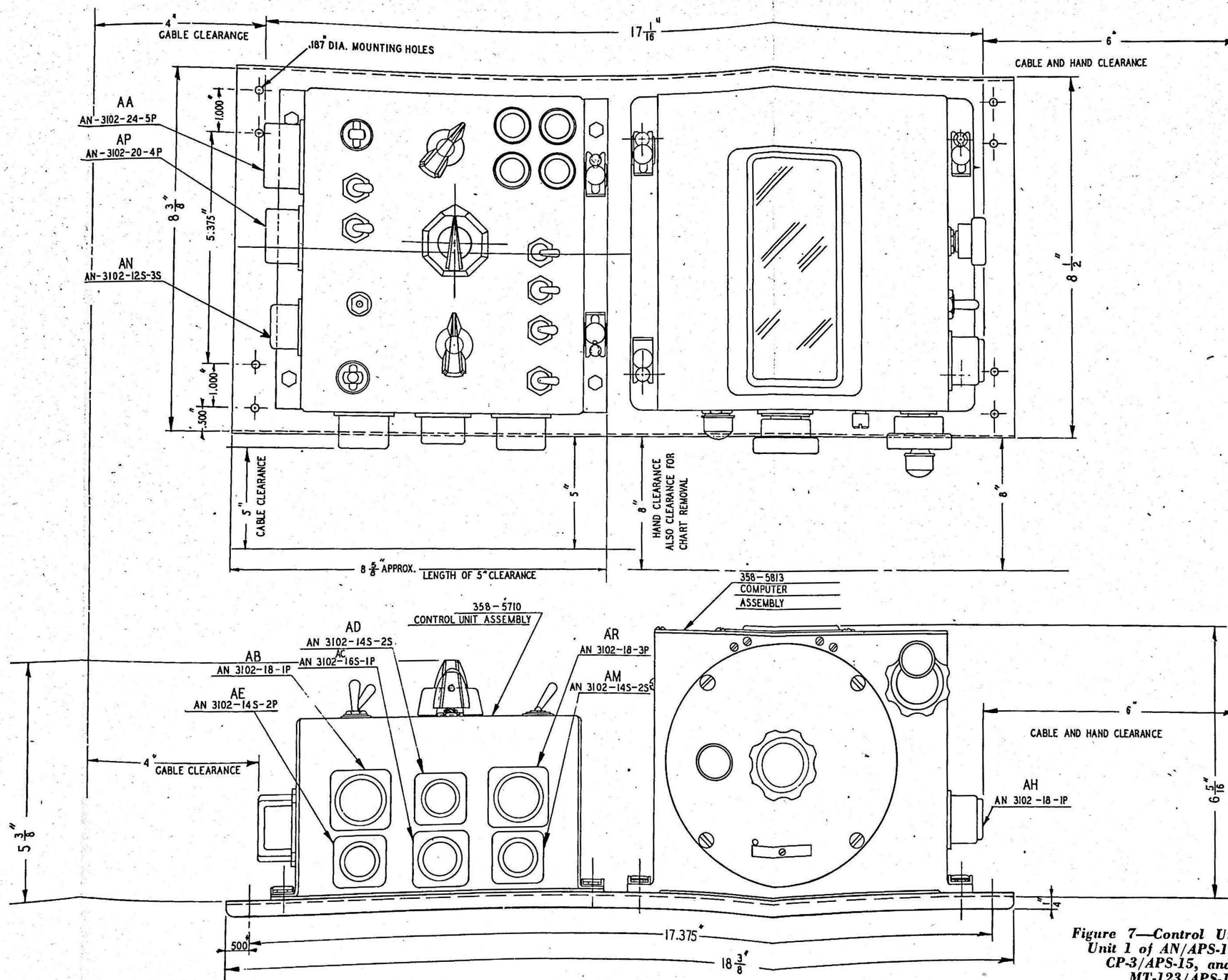


Figure 7—Control Unit C-33A/APS-15 or Unit 1 of AN/APS-15(XN-1), Computer CP-3/APS-15, and Mounting Base MT-123/APS-15, Installation Details

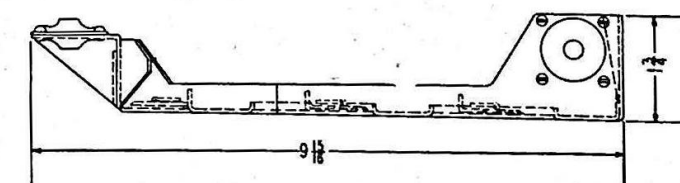
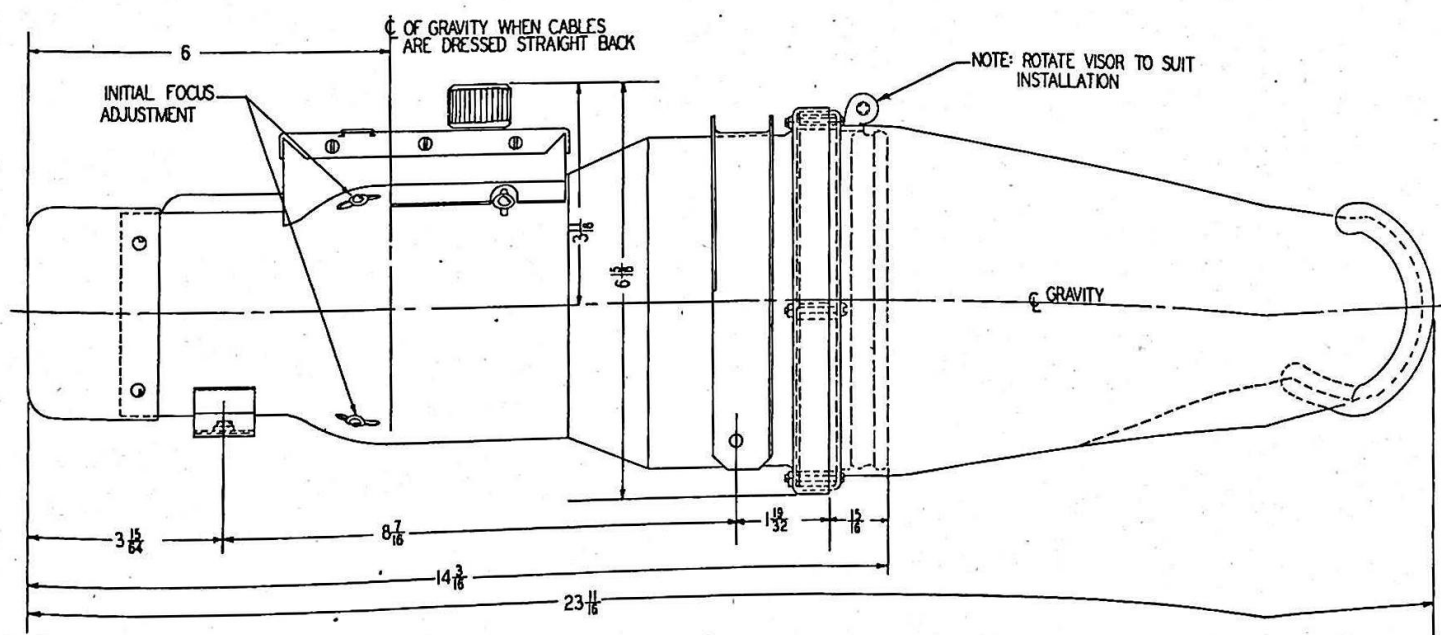
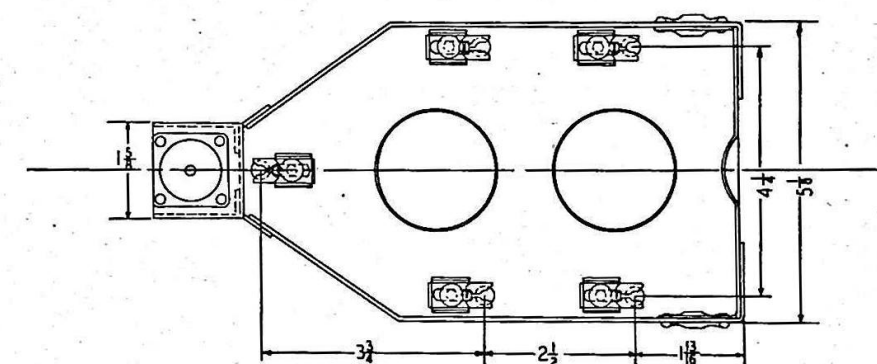
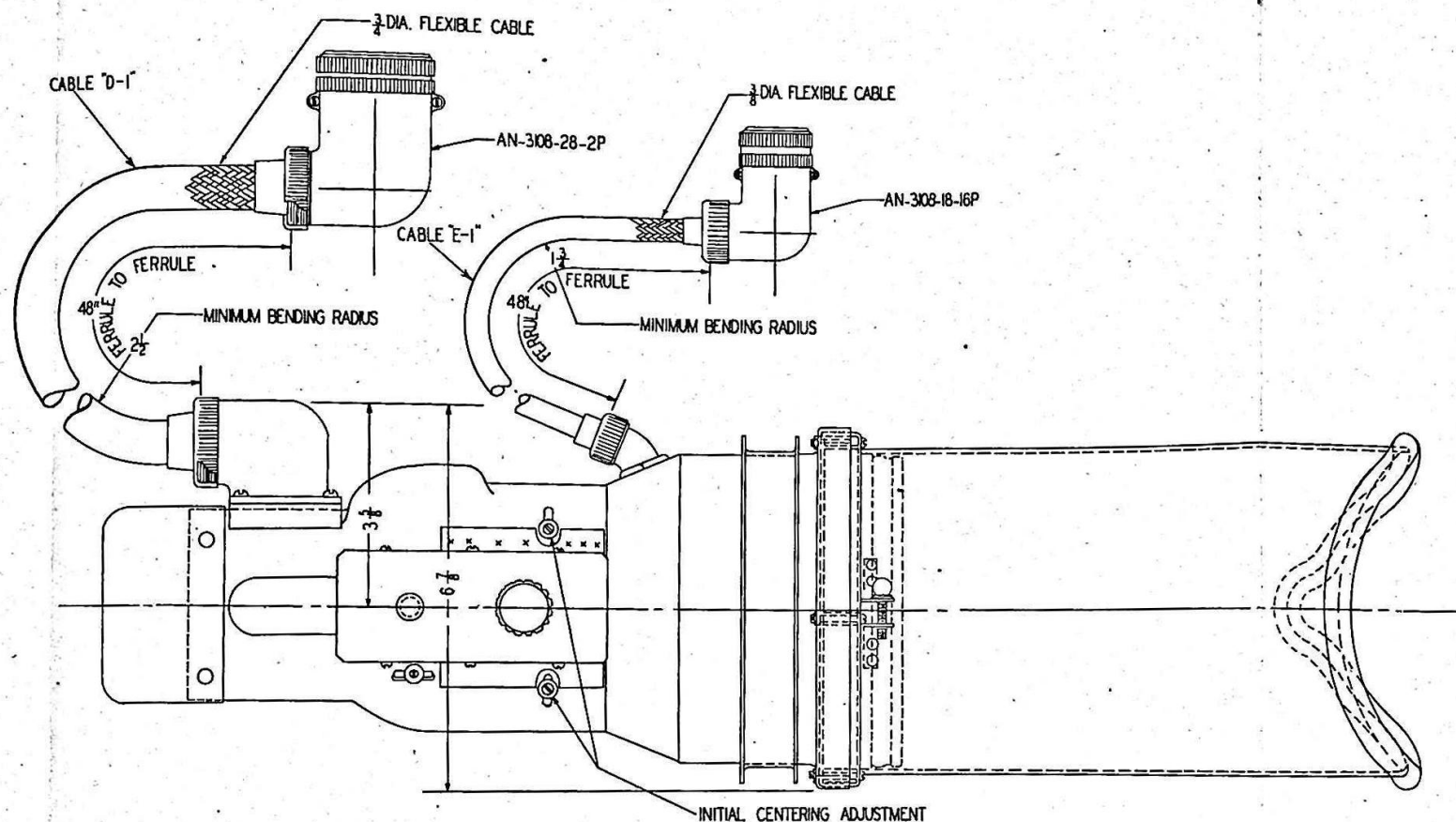
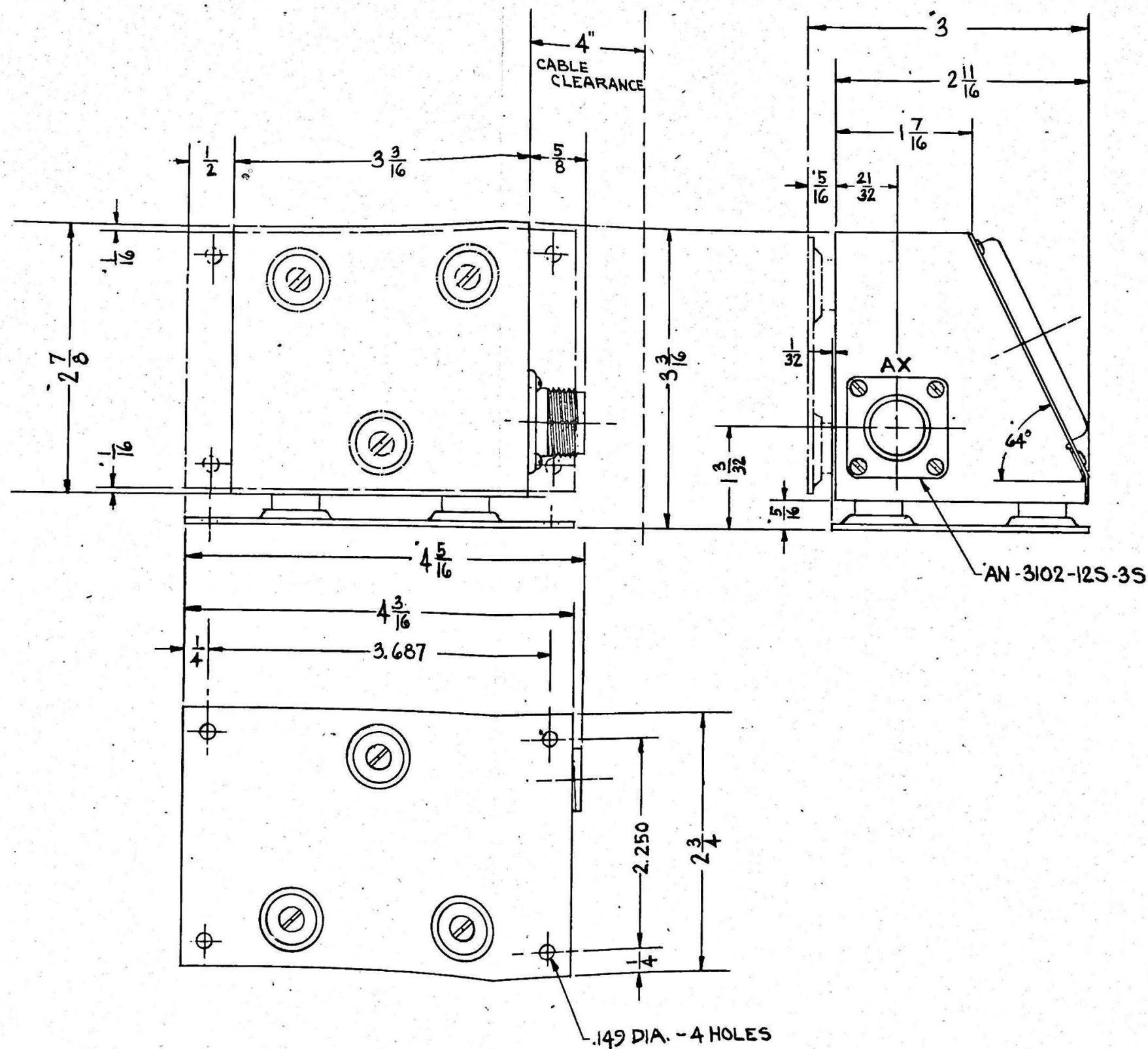


Figure 8—Plan Repeater Indicator ID-30/APS-2D
and Mounting Base MT-95/APS-3,
Installation Details



NOTE:—
DOT AND DASH LINES SHOW
BASE PLATE MOUNTED IN
ALTERNATIVE POSITION.
BUTTONS TO BE PLACED IN
HOLES NOT USED.

Figure 9—Milliammeter TS-116/APS-15 (Crystal-
Current Meter), Installation Details

ITEM	PHILCO PART NO.	DESCRIPTION	QTY.	REMARKS
1	247-1068	Felt pad	1	
2	248-1611	Dust cover	1	
3	1W-28748FA22	Screw, fillister hd. mach., 10-32, 5/16" long	3	Mounting items 1 and 2.
4	1W-35047FA22	Lockwasher, split, #10 std.	3	
5	348-1432	Tilt rod Assy.	1	
6	248-1073	Pin (attaches tilt rod to tilt ring)	1	These parts were removed with the original tilt arm assembly
7	1W-35741FA22	Cotter pin, 1/16" x 1/2" long	1	
8	247-1066	Rubber bellows	1	Part of original tilt arm assembly.
9	248-3020	Support (for shelf)	1	
10	1W-28811FA22	Screw, fillister hd. mach., 1/4"-20x7/8" long	1	
11	1W-28808FA22	Screw, fillister hd. mach., 1/4"-20x3/16" long	1	Mounting item 9 to rotating head.
12	1W-35032FA22	Lockwasher, split, 1/4" (light)	2	
*13	348-1616	Gyro-servo and shelf assembly in Tilt Stabilization Kit AN/APA-15 (XN-1)	1	Mounting Base Unit 3 of AN/APA-15 (XN-1) Gyro Torque Unit, Unit 2 of AN/APA-15 (XN-1), and Servo Amplifier Unit 1 of AN/APA-15 (XN-1).
	348-1617	Gyro-servo and shelf assembly in Tilt Stabilization Kit AN/APA-15	1	Mounting Base MT-131/APA-15, Gyro Torque Unit CN-5/APA-15, and Servo Amplifier AM-21/APA-15.
14	1W-28734FA22	Screw, fillister hd. mach., 10-24, 3/4" long	2	Mounting item 13 to item 9.
15	1W-35047FA22	Lockwasher, split, #10 std.	2	
16	248-3022	Bracket (starboard)	1	
17	248-3023	Bracket (port)	1	Mounting item 13 to support arms.
18	248-3024	Clamp	2	
19	1W-28733FA22	Screw, fillister hd. mach., 10-24, 5/8" long	8	
20	1W-30098FA22	Groov-pin 1/8"x1/16" long	4	Mounting items 13, 16, 17, and 18.
21	1W-35047FA22	Lockwasher, split, #10 std.	8	
22	1W-29733FA22	Screw, fillister hd. mach., 10-24, 5/8" long	4	
23	1W-52563FA22	Washer, flat, steel, .199" I.L. 3/4" O.D., .062" thick	4	Mounting item 13 to items 16 and 17.
24	1W-35047FA22	Lockwasher, split, #10 std.	4	
25	1W-21018FA22	Jam nut, hex, 5/16"-24	1	Locking clevis on tilt rod.
26	248-1424	Clevis	1	Connecting tilt rod to gyro torque unit.
27	248-1073	Pin	1	Attaching clevis to gyro torque unit.
28	1W-35741FA22	Cotter pin, 1/16" x 1/2" long	1	
29	248-3017	Tilt arm	1	
30	1W-28734FA22	Screw, fillister hd. mach., 10-24, 3/4" long	4	Mounting item 29 to channel.
31	1W-28691FA22	Screw, fillister hd. mach., 8-32, 9/16" long	2	
32	1W-35047FA22	Lockwasher, split, #10 std.	4	
33	1W-35046FA22	Lockwasher, split, #8 std.	2	
34	348-1434	Linkage Assy.	1	Connecting gyro torque unit to tilt arm.
35	248-1911	Special stud	2	Mounting item 34 to gyro torque unit and tilt arm.
36	1W-22892FA22	Boots nut, 10-32	2	
37	248-3223	Counter weight	1	
38	1W-11369FA22	Screw, fillister hd. mach., 1/4"-28 x 1" long	1	Mounting item 37 to channel.
39	1W-11371FA22	Screw, fillister hd. mach., 1/4"-28 x 1 1/4" long	1	
40	1W-22893FA22	Boots nut, hex, 1/4"-28	2	
41	248-3222	Brace, counter weight	1	
42	1W-11330FA22	Screw, fillister hd. mach., 10-32, 3/4" long	2	Attaching item 41 to channel.
43	1W-22892FA22	Boots nut, 10-32	2	
44	1W-28826FA22	Screw, fillister hd. mach., 1/4"-28 x 9/16" long	1	Attaching item 41 to counter weight. Screw and washer were removed from old counter weight assembly.
45	1W-35049FA22	Lockwasher, split, 1/4" std.	1	

* Items 14 to 24 inclusive are also a part of the gyro-servo and shelf assembly, item 13.

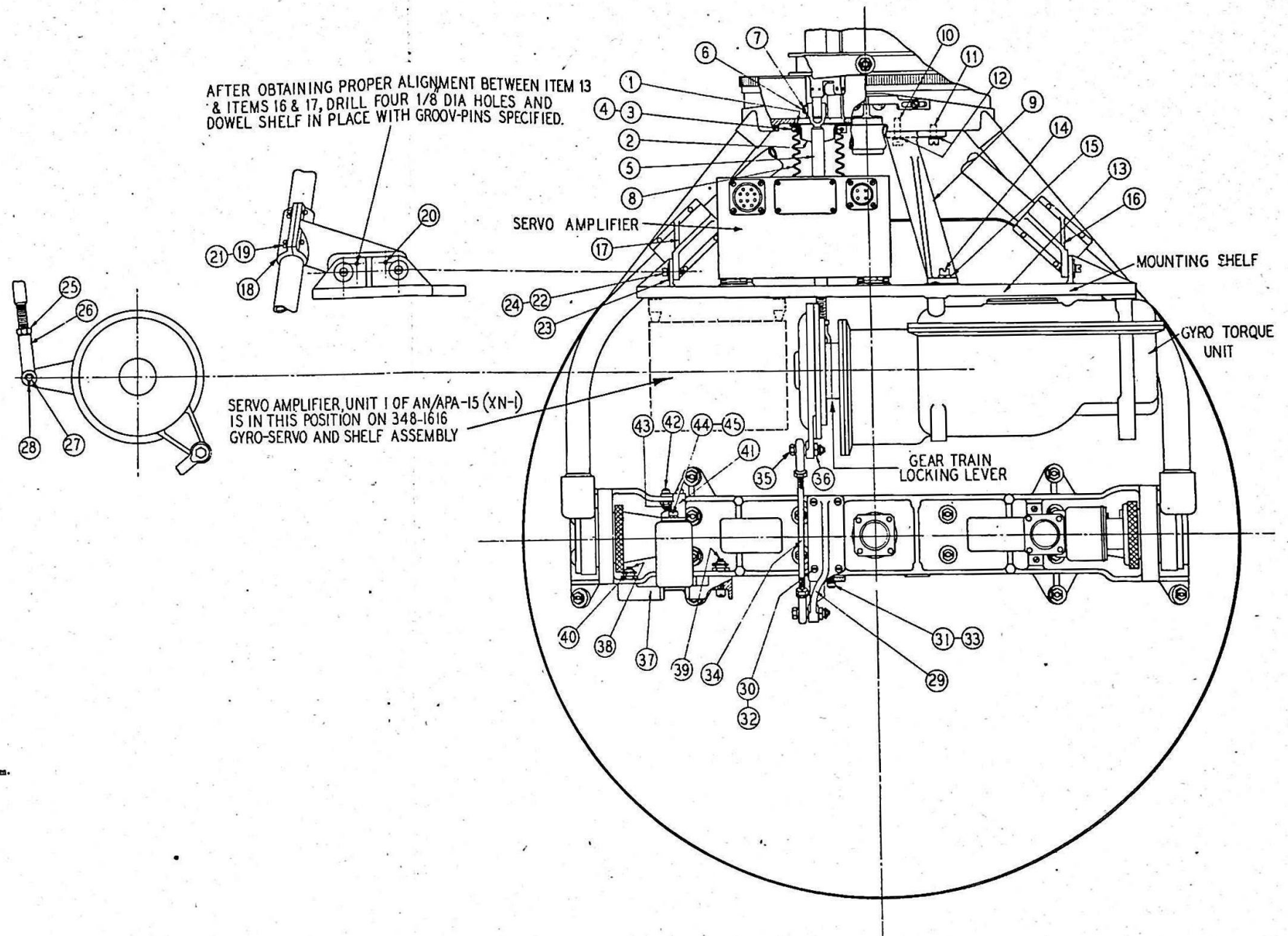


Figure 10—Tilt-Stabilization Kit AN/APA-15 or AN/APA-15(NX-1), Installation Details

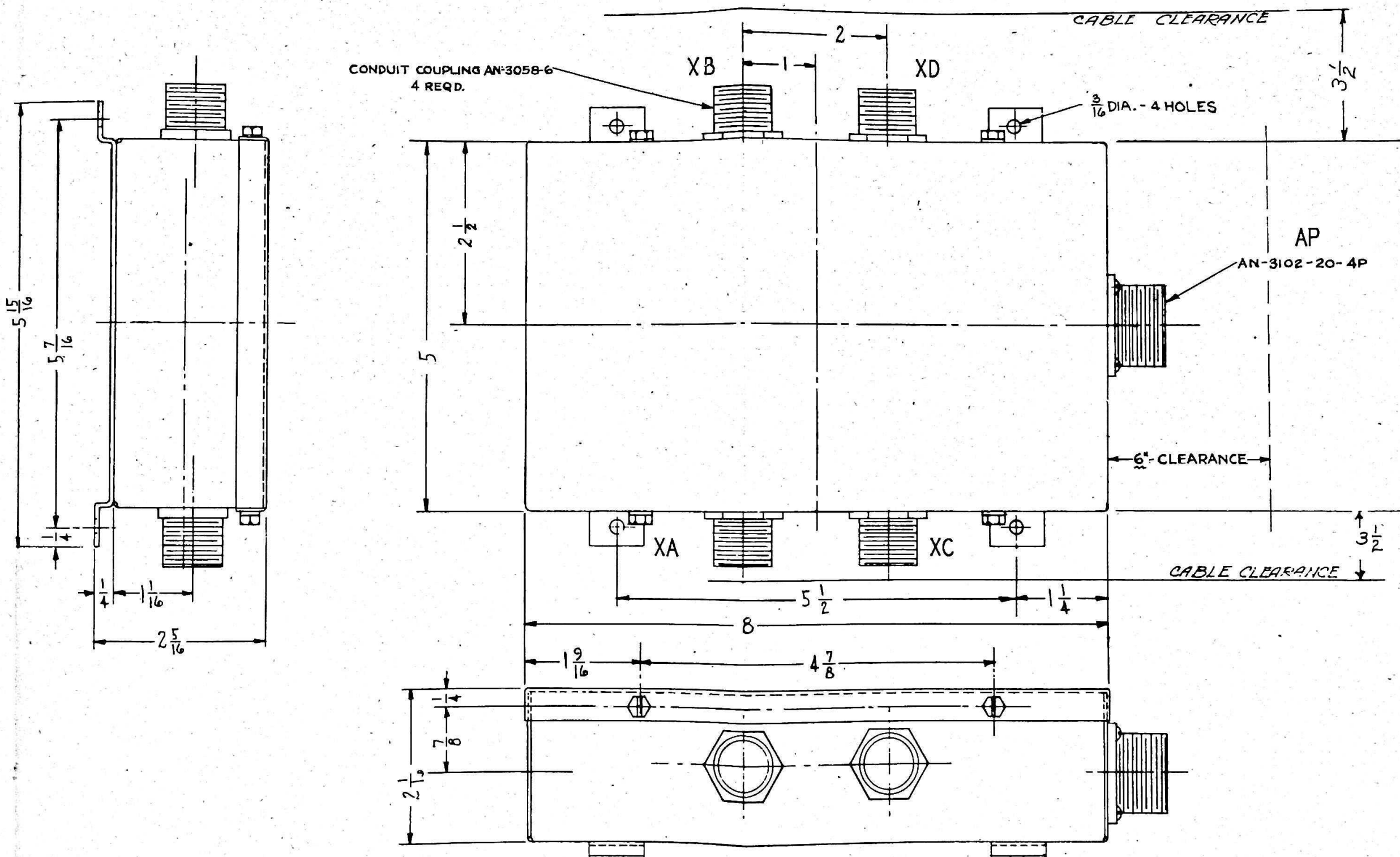


Figure 12—Junction Box Unit 5 of
AN/APA-15(XN-1) (Tilt Power),
Installation Details

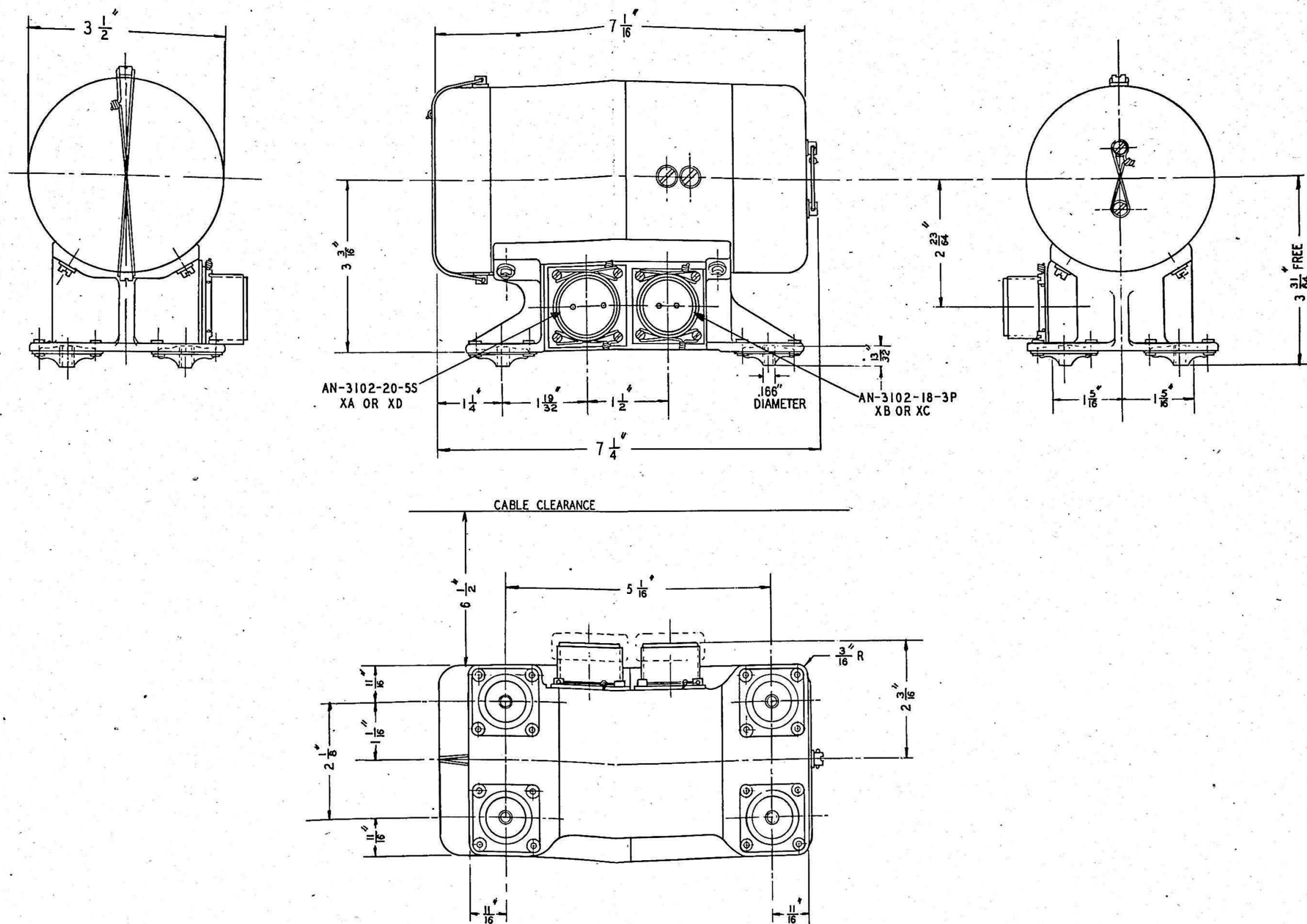


Figure 13—Rotary Converter Unit 4 of AN/APA-15(XN-1) (Single Phase), Installation Details

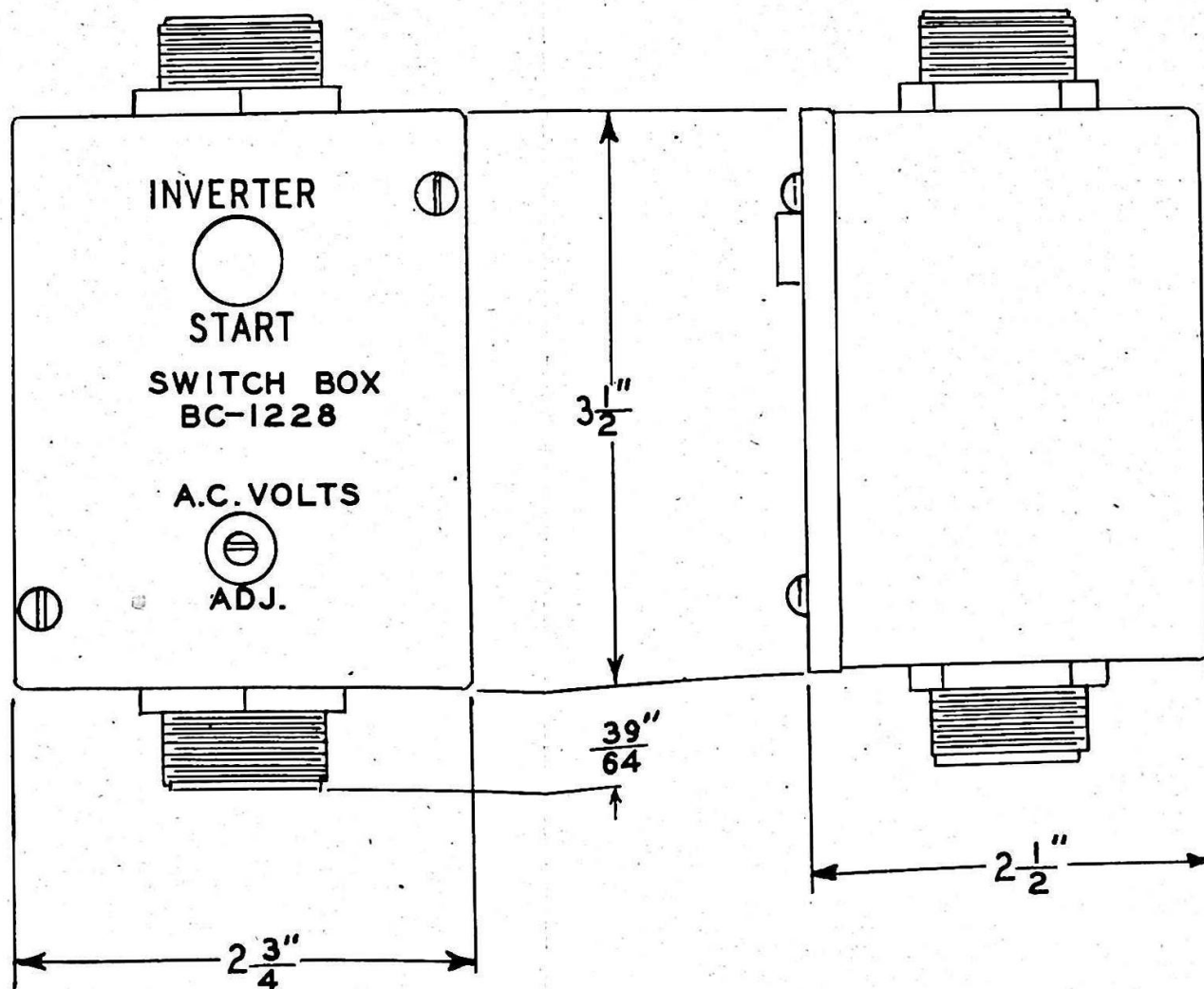
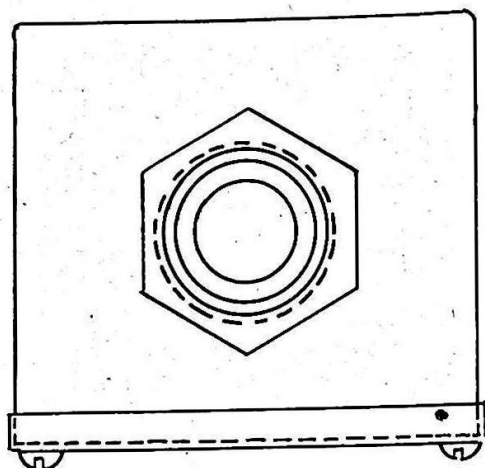


Figure 14—Switch Box BC-1228, Installation
Details (For AAF Use Only)

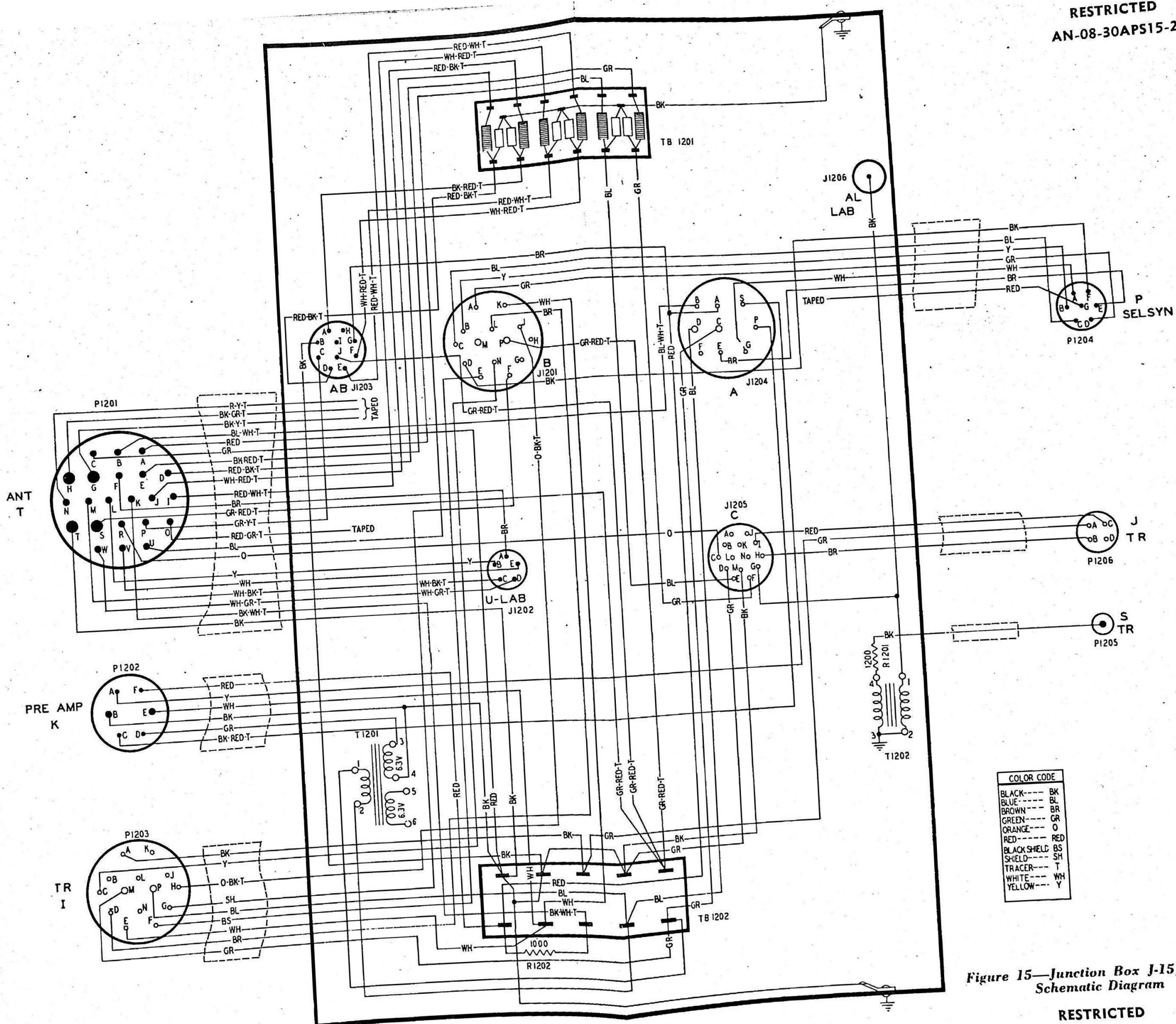


Figure 15—Junction Box J-15/APS-15,
Schematic Diagram

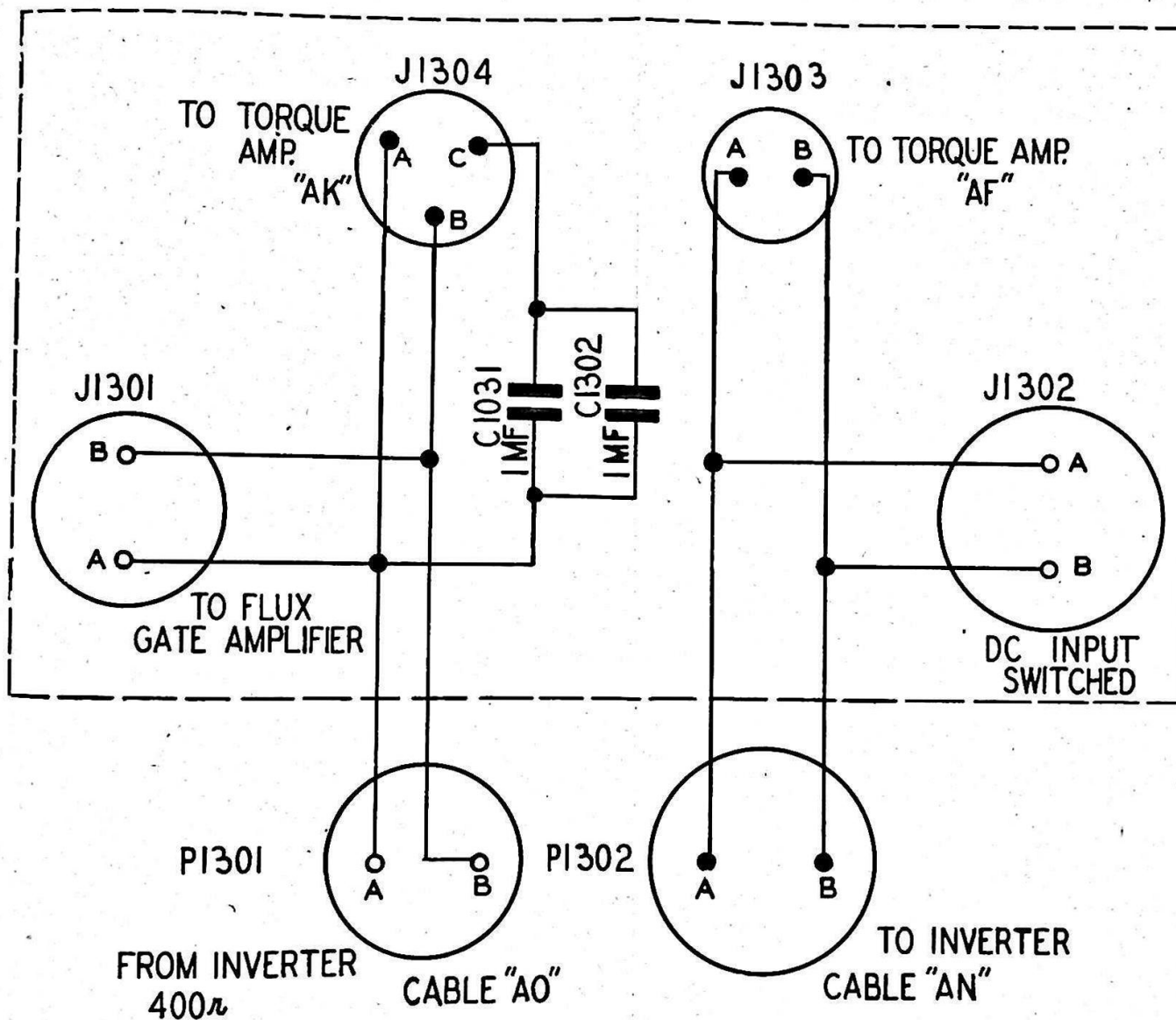


Figure 16—Junction Box J-35/APA-14 (Torque Amplifier), Schematic Diagram

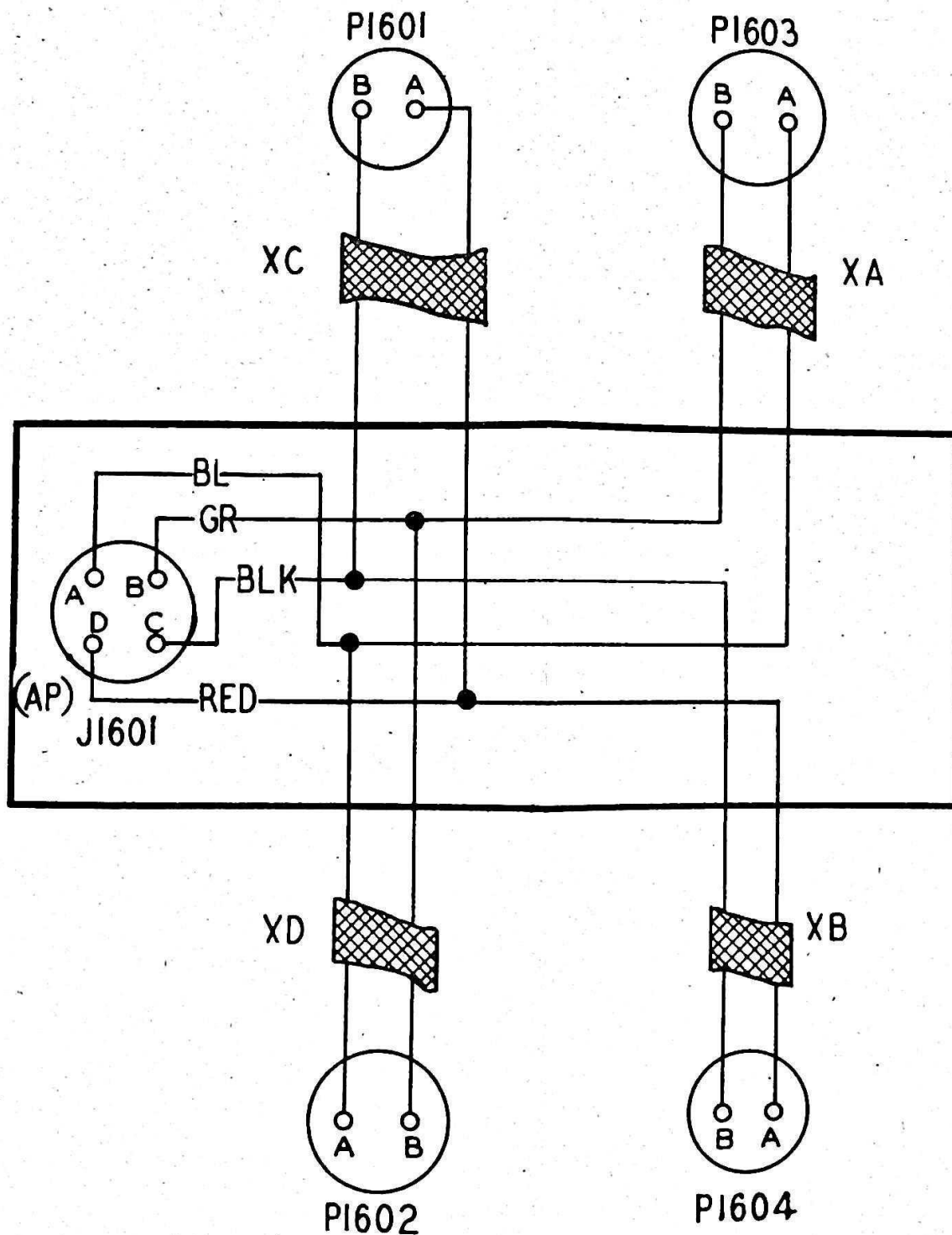
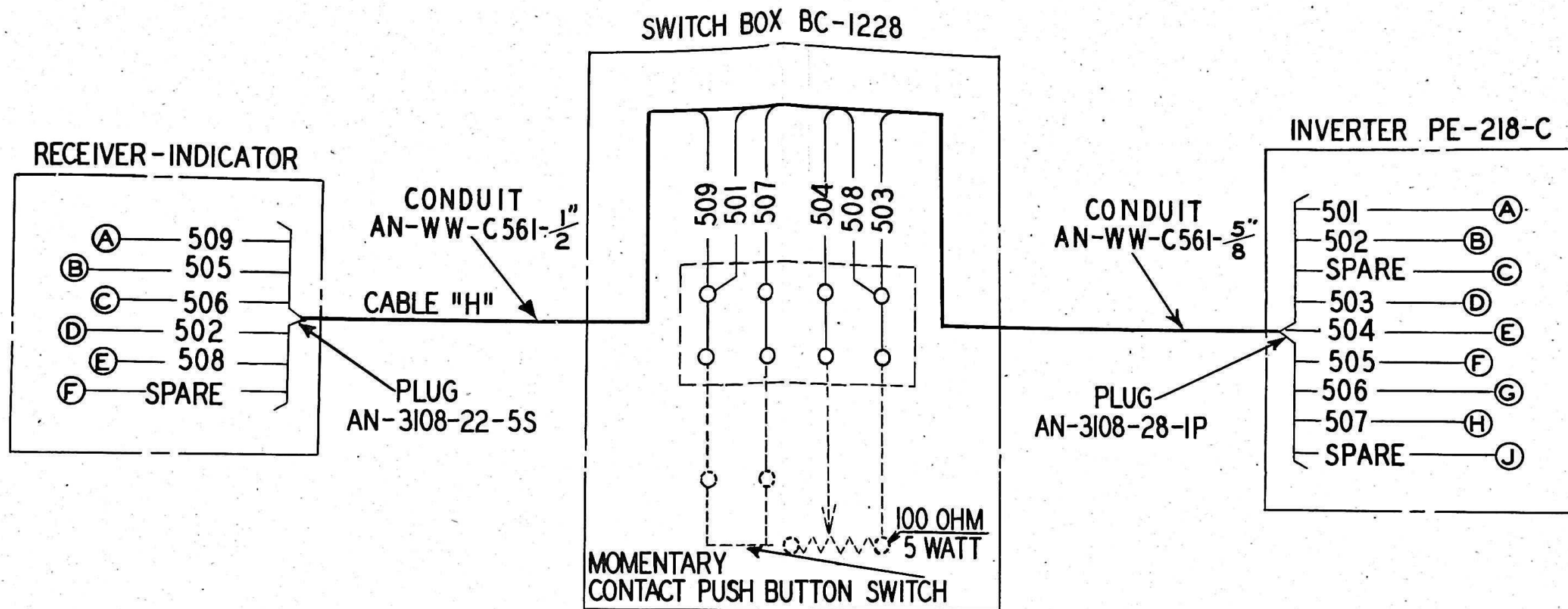


Figure 17—Junction Box Unit 5 of
AN/APA-15(XN-1) (Tilt Power),
Schematic Diagram



WIRE NO.	WIRE SIZE
501	#16
502	#16
503	#14
504	#16
505	#14
506	#14
507	#16
508	#14
509	#16

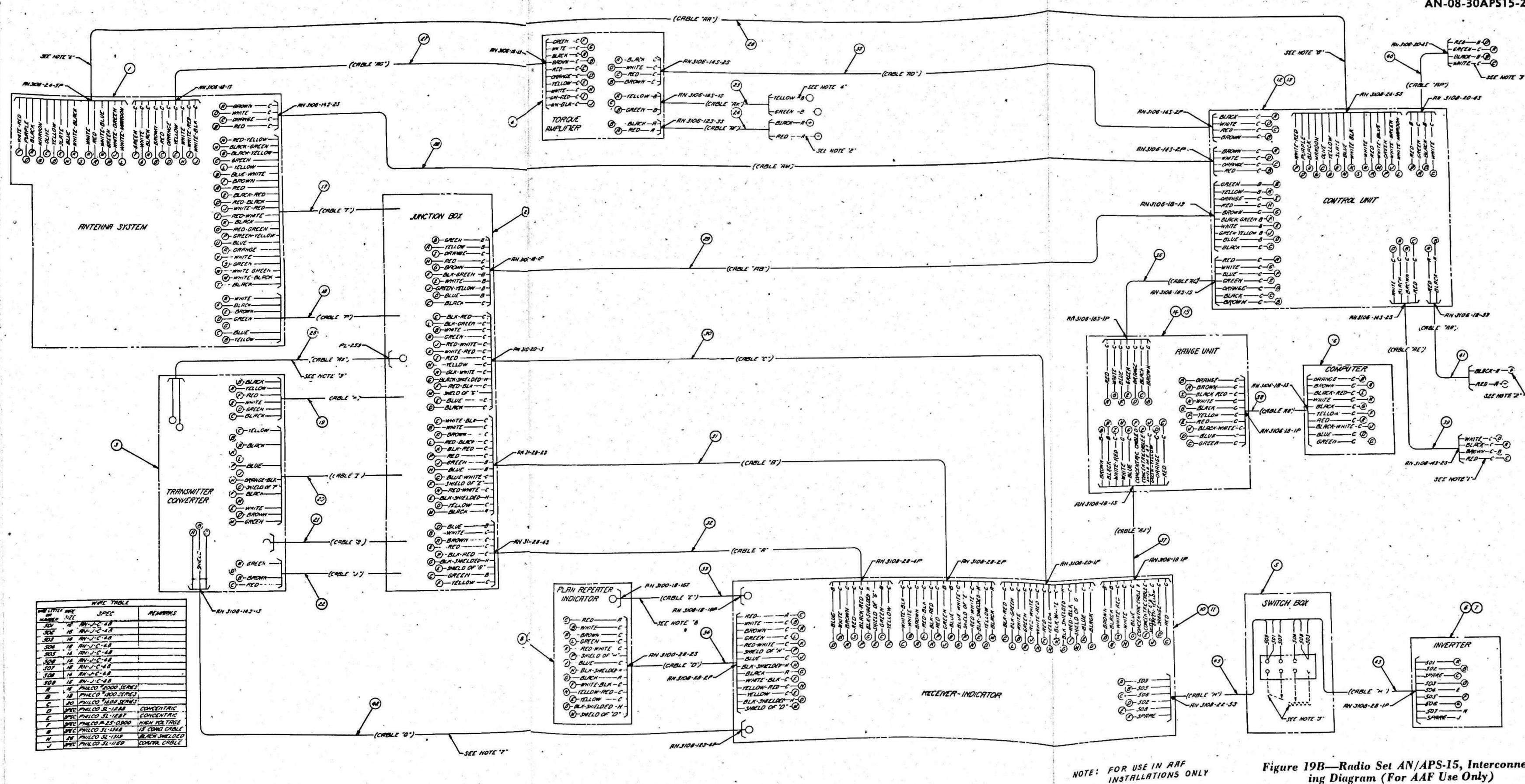
ALL WIRES TO BE PER SPEC. AN-J-C-48
UNLESS OTHERWISE SPECIFIED.

Figure 18—Connection of Switch Box BC-1228 and Inverter PE-218-C to Receiver-Indicator, Schematic Diagram (For AAF Use Only)

ITEM	DESCRIPTION	REF.	QUANTITY	REMARKS
1	ANTENNA SYSTEM	1	1	
2	TRANSMITTER CONVERTER	1	1	
3	RECEIVER-INDICATOR	1	1	
4	PLANE REPEATER INDICATOR	1	1	
5	CONCENTRIC CABLE	1	1	
6	CONDUCTOR CABLE	1	1	
7	CONDUCTOR CABLE	1	1	
8	CONDUCTOR CABLE	1	1	
9	CONDUCTOR CABLE	1	1	
10	CONDUCTOR CABLE	1	1	
11	CONDUCTOR CABLE	1	1	
12	CONDUCTOR CABLE	1	1	
13	CONDUCTOR CABLE	1	1	
14	CONDUCTOR CABLE	1	1	
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97	CONDUCTOR CABLE	1	1	
98	CONDUCTOR CABLE	1	1	
99	CONDUCTOR CABLE	1	1	
100	CONDUCTOR CABLE	1	1	

- 1. CABLE "A" IS FABRICATED WITH PHILCO CABLE SL-148
- 2. CABLE "B" IS FABRICATED WITH PHILCO CABLE SL-148 (5000 VOLT HIGH VOLTAGE CABLE)
- 3. CABLE "C" IS FABRICATED WITH PHILCO CONCENTRIC CABLE SL-148
- 4. CABLE "D" IS FABRICATED WITH PHILCO CONCENTRIC CABLE SL-148, IS CONDUCTOR, SPECIAL CABLE
- 5. THE INVENTORIAL CONTACT PUSH BUTTON SWITCH AND THE 100 OHM, 5 WATT POTENTIOMETER ARE ALREADY WIRED IN THE SWITCH BOX (SEE NOTE 1)
- 6. CONNECTS TO A C POWER. YELLOW WIRE CONNECTS TO GROUND, GREEN WIRE CONNECTS TO 115 VOLTS
- 7. WHEN NOT USED, THIS PLUS SHALL BE TIED UP OUT OF THE WAY.
- 8. CONNECTS TO 28 VOLT D.C. POWER SOURCE. BLACK WIRE - RED WIRE -
- 9. CONNECTS TO REPEATER INDICATOR, FLIGHT COMPASS SYSTEM.

Figure 19A—Radio Set AN/APS-15, Schedule of Cabling (For AAF Use Only)



NOTE: FOR USE IN AAF INSTALLATIONS ONLY

Figure 19B—Radio Set AN/APS-15, Interconnecting Diagram (For AAF Use Only)

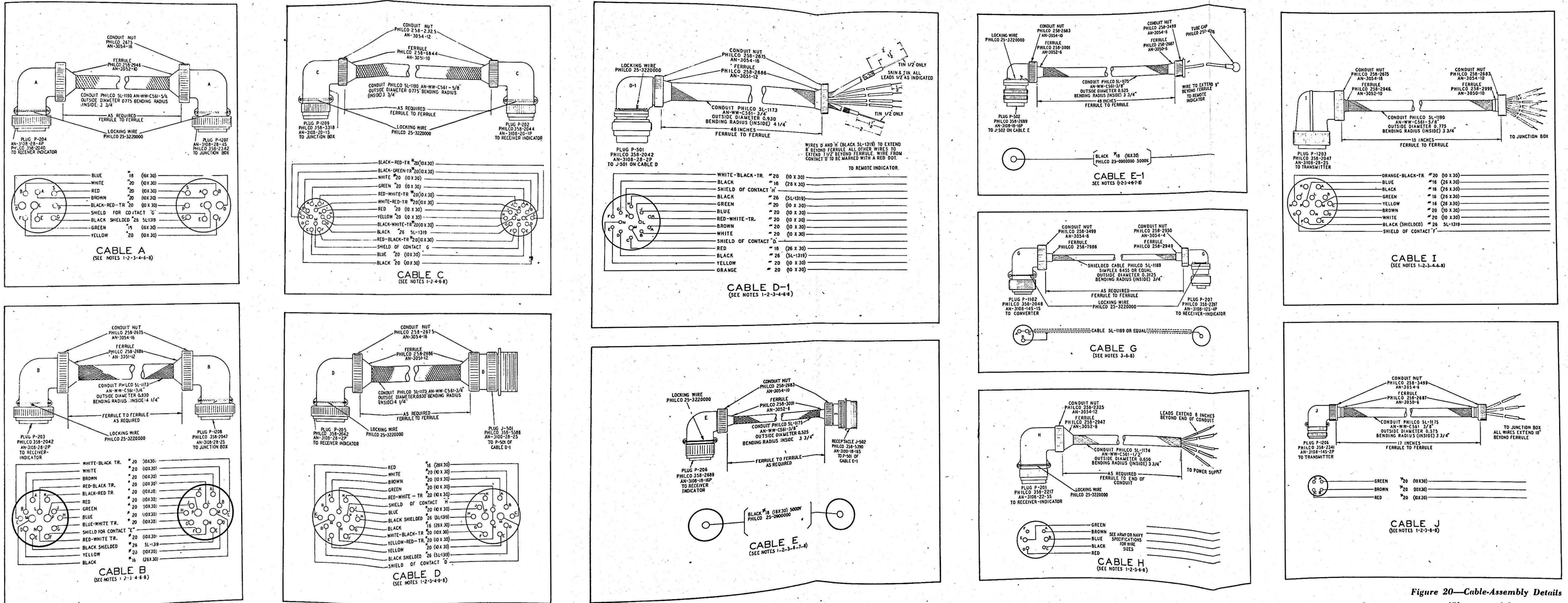
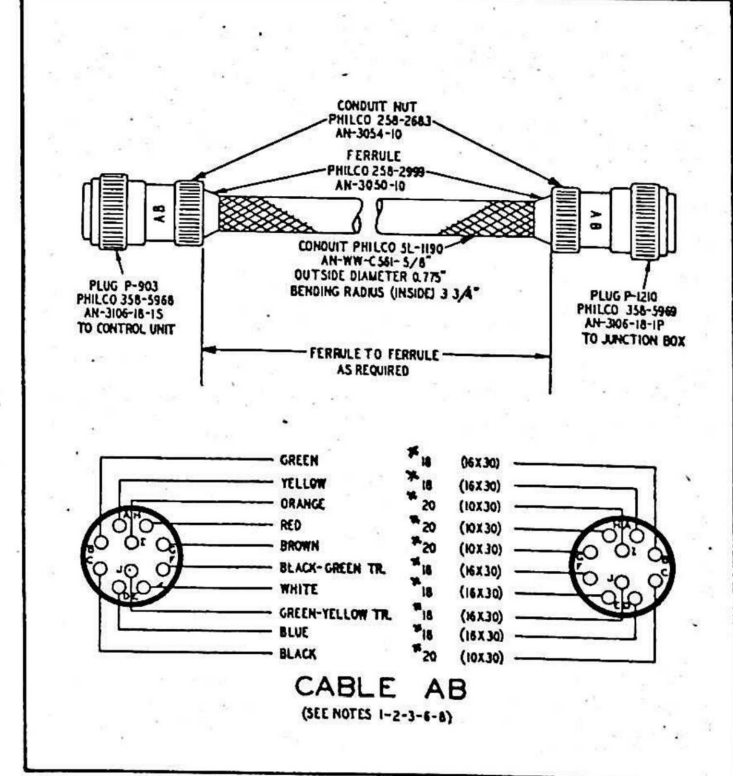
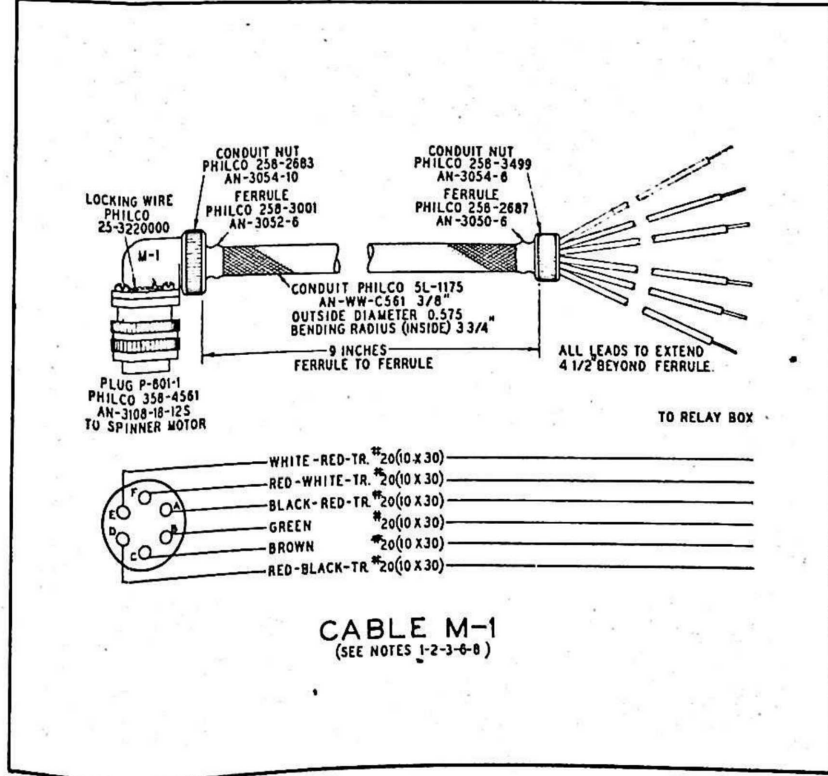
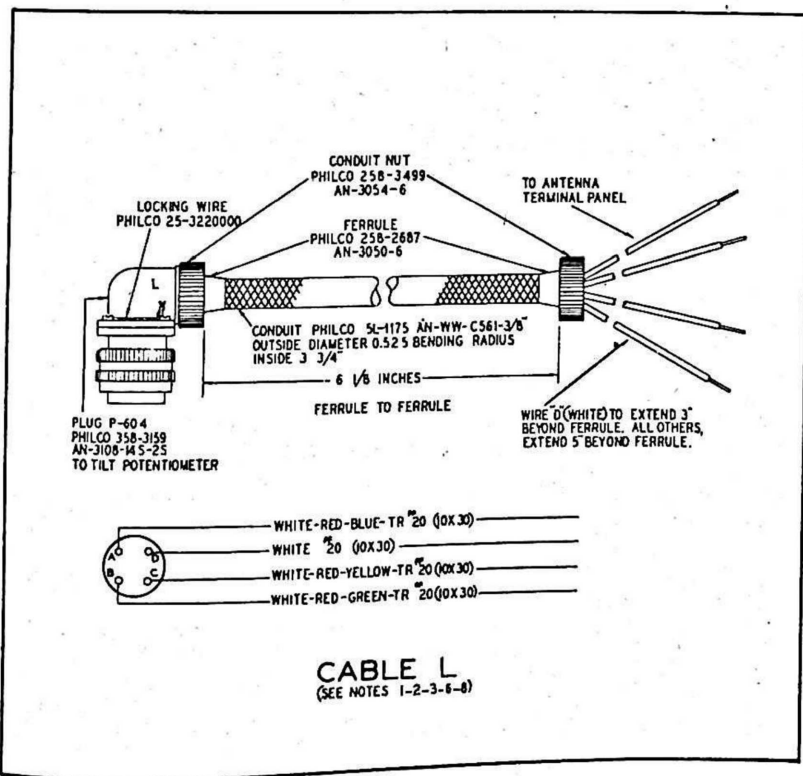
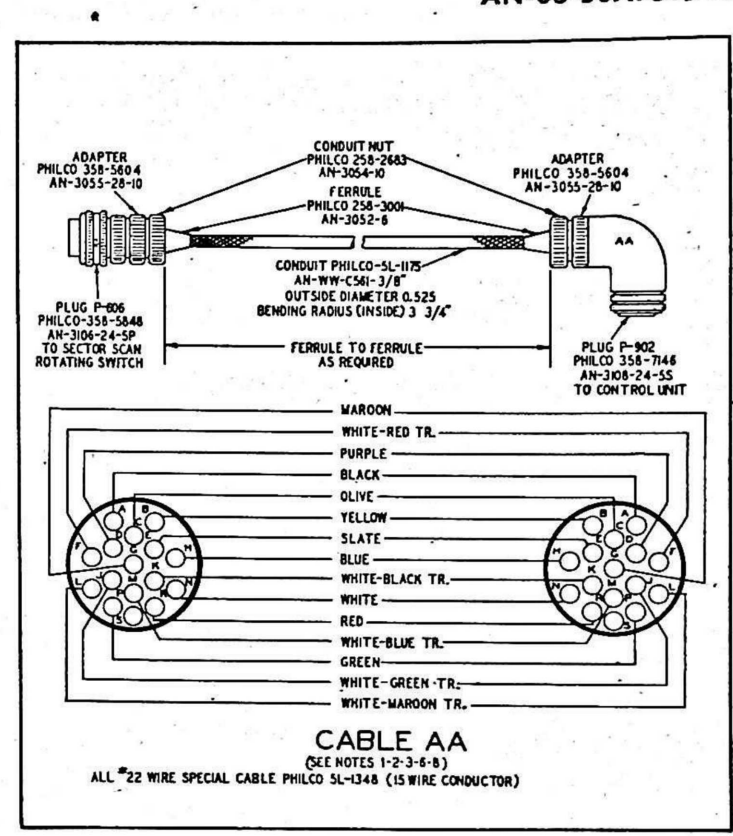
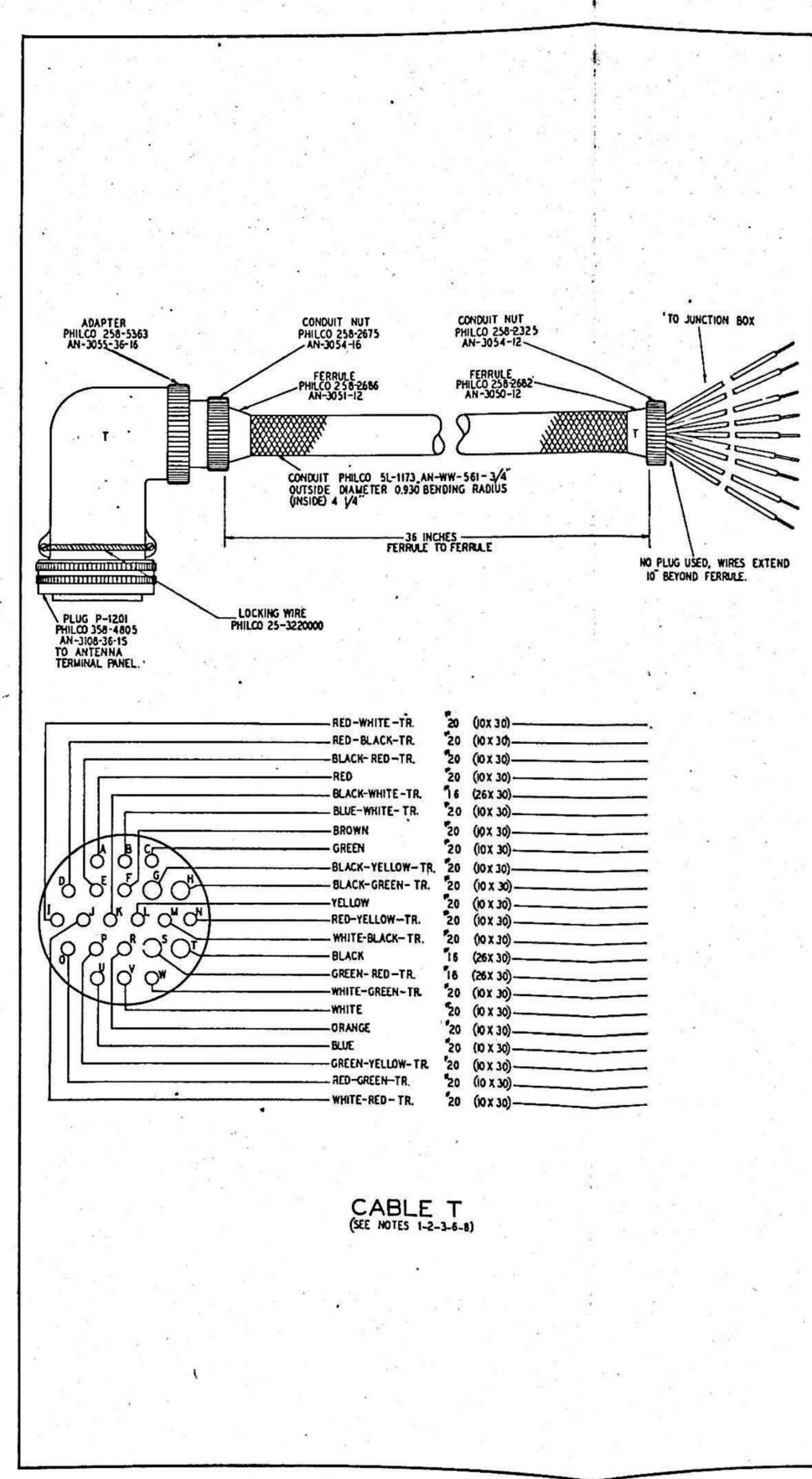
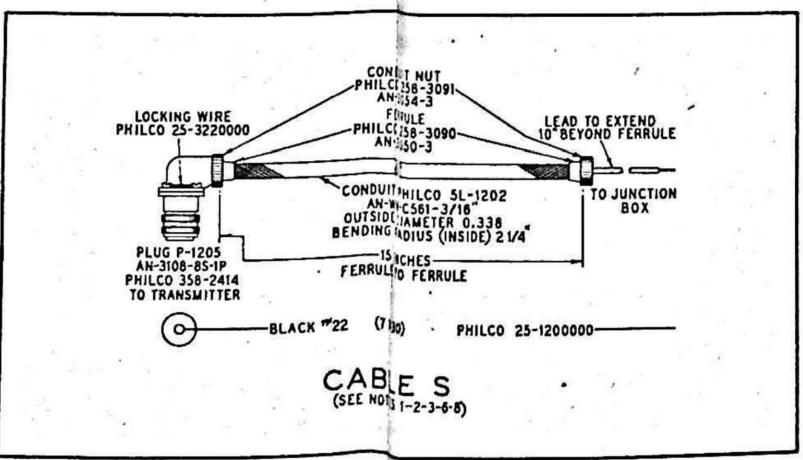
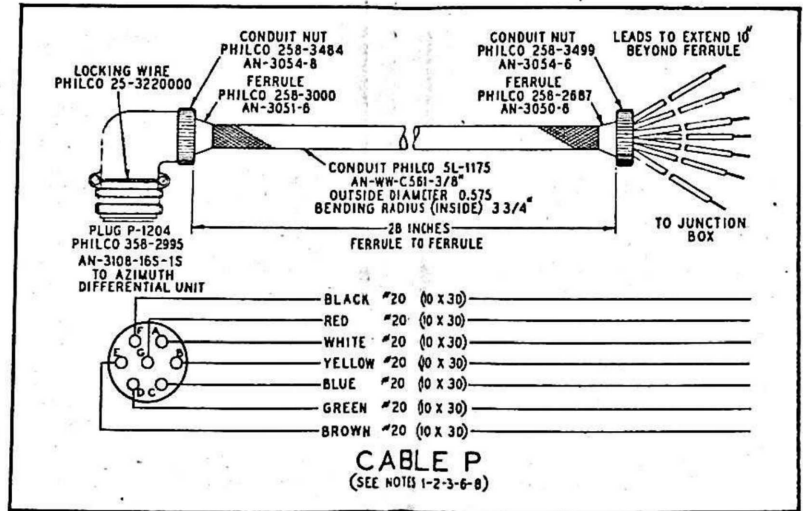
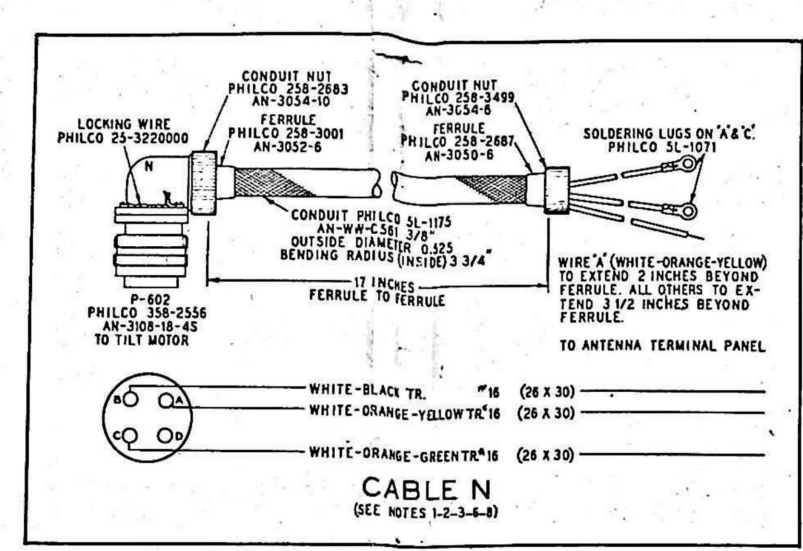
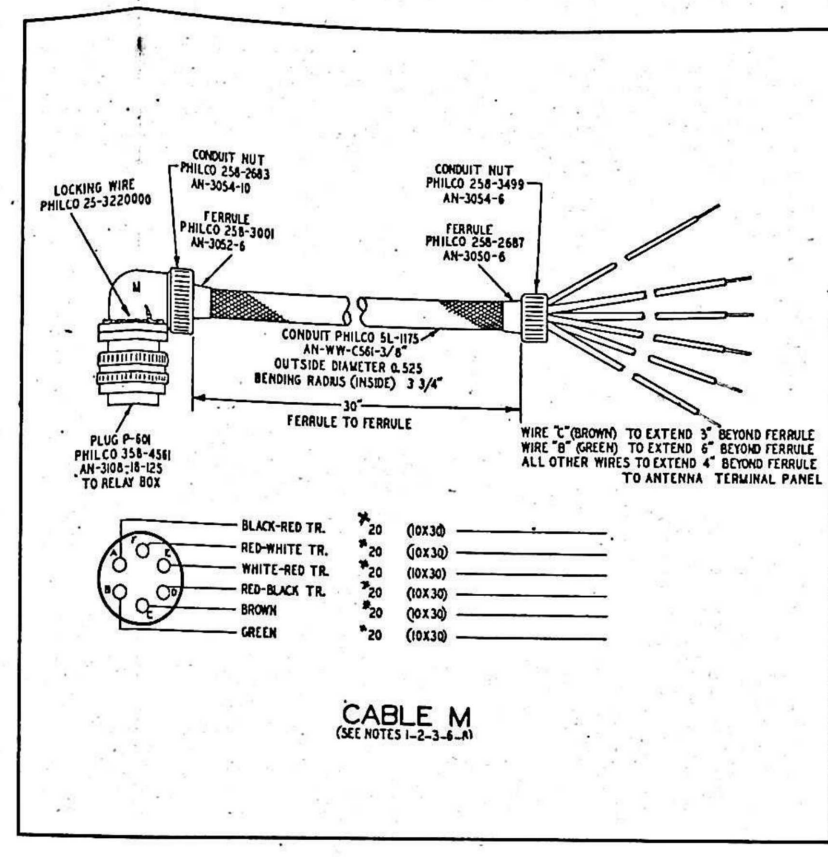
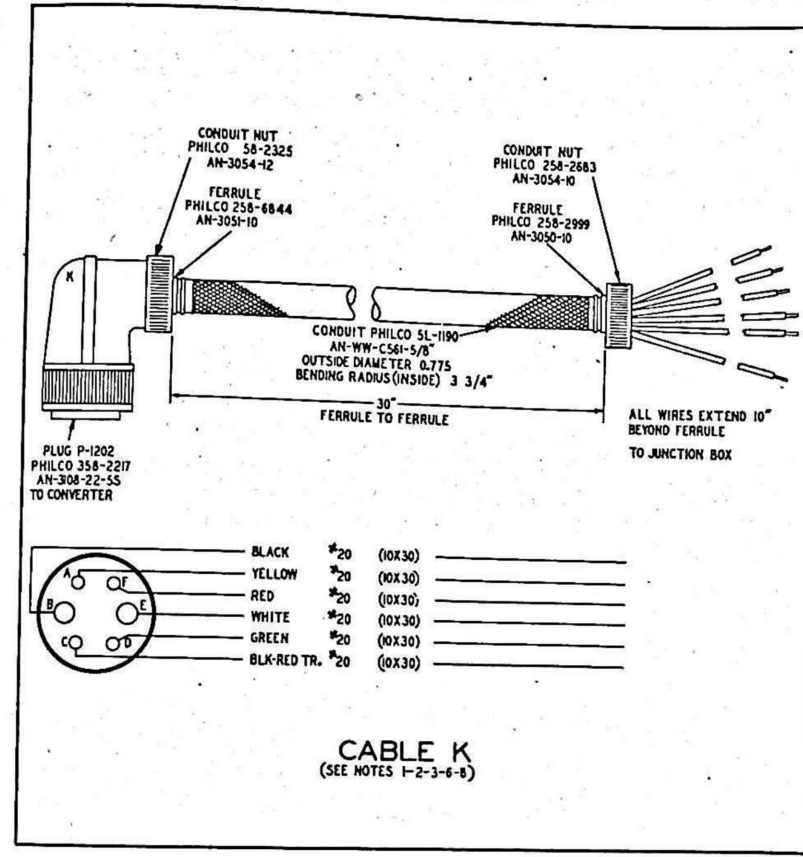


Figure 20—Cable-Assembly Details
(Sheet two of five)
RESTRICTED



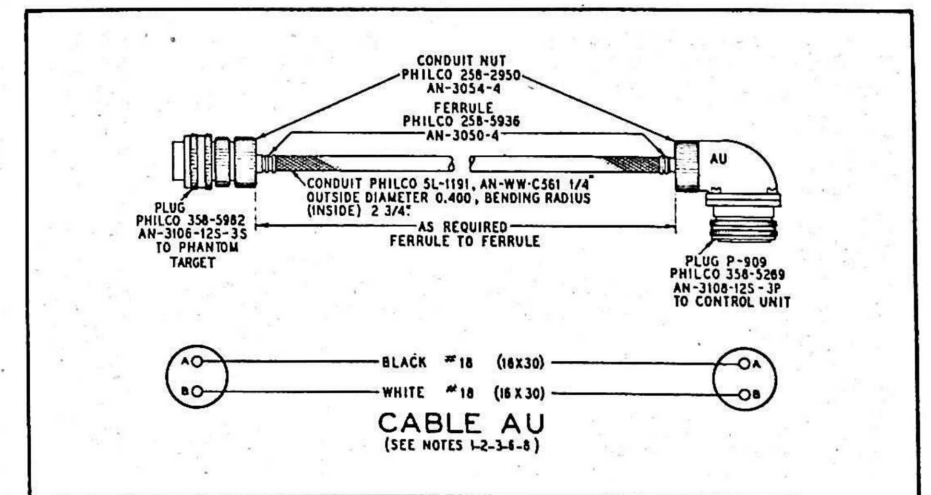
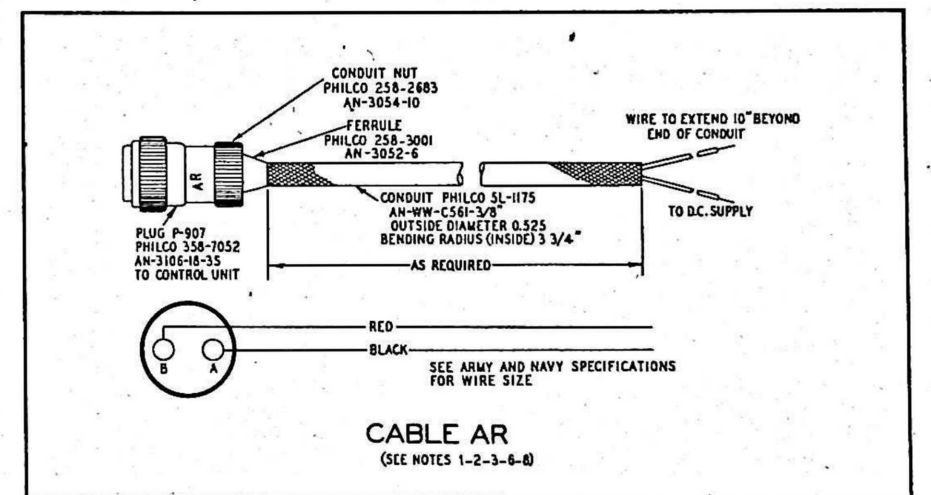
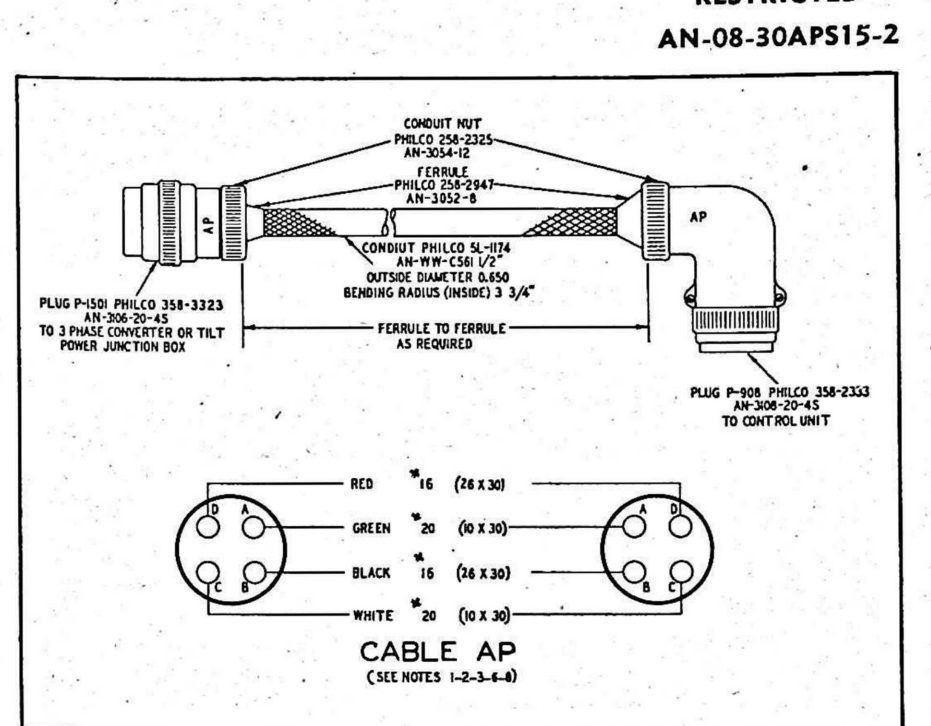
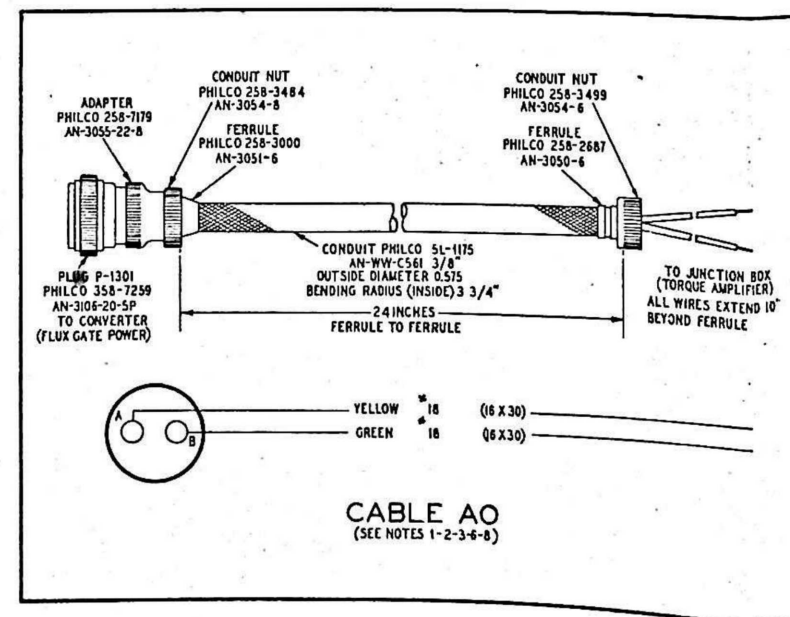
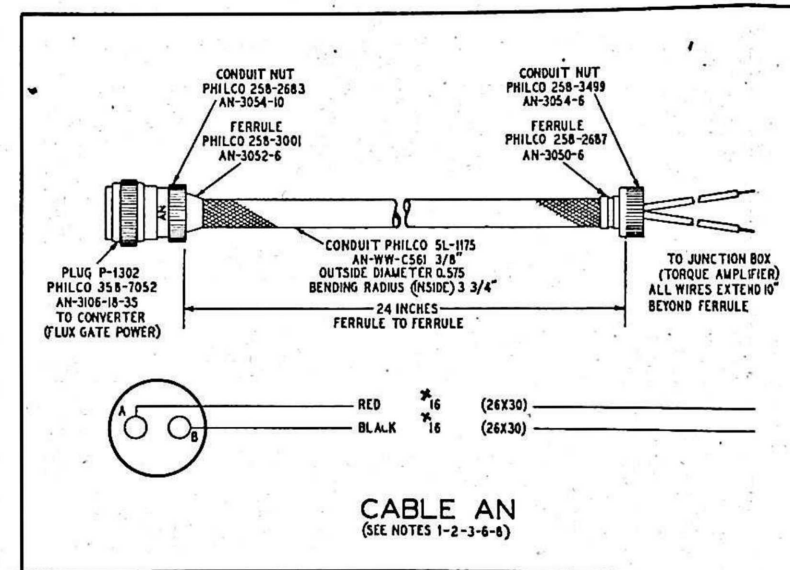
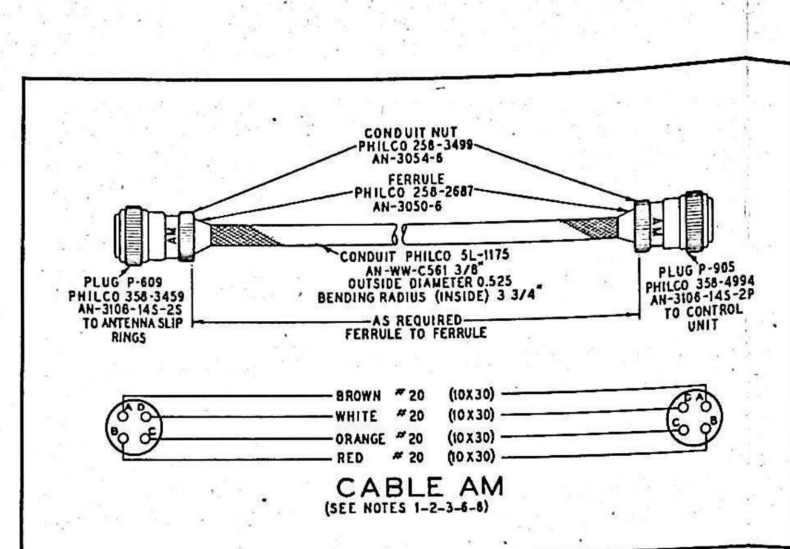
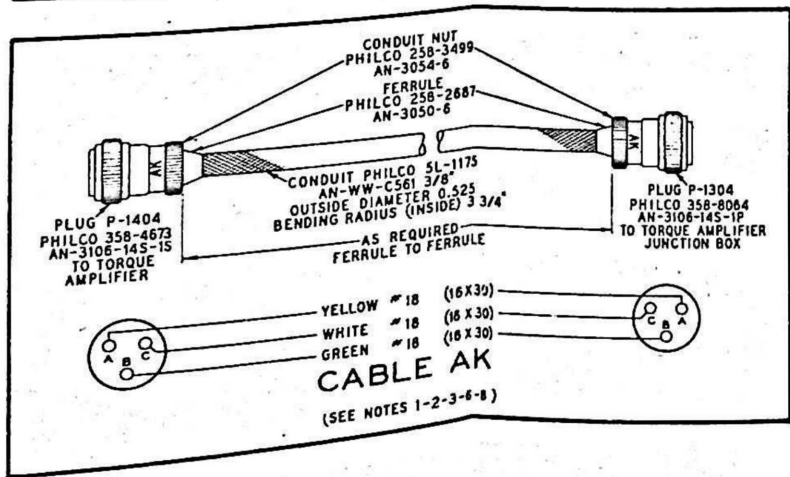
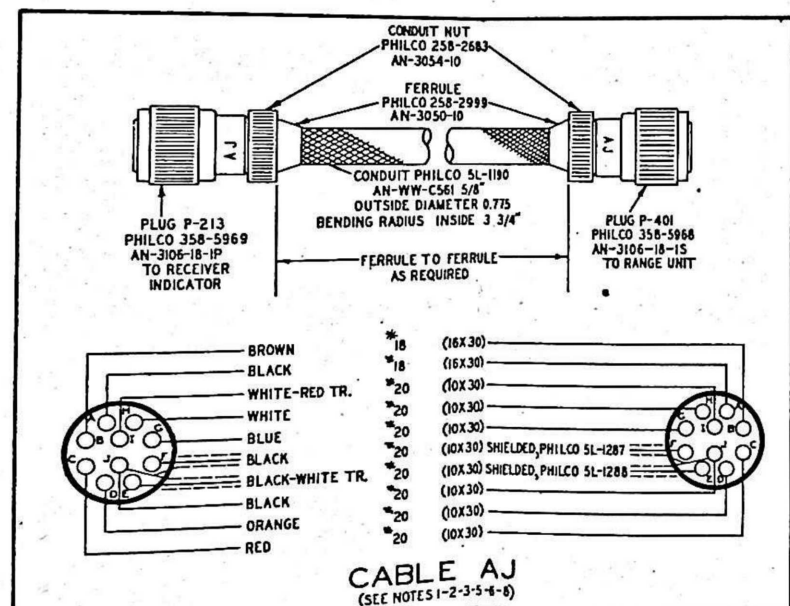
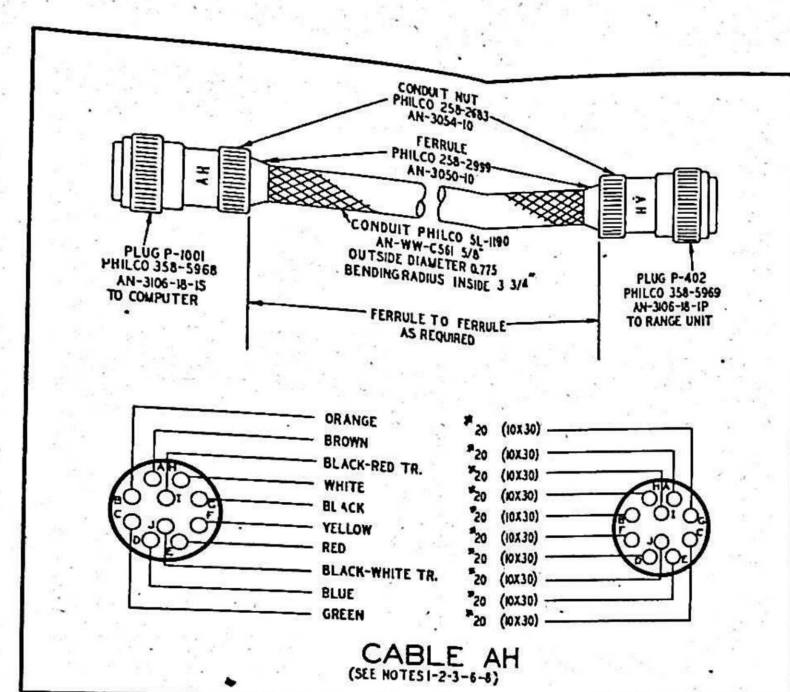
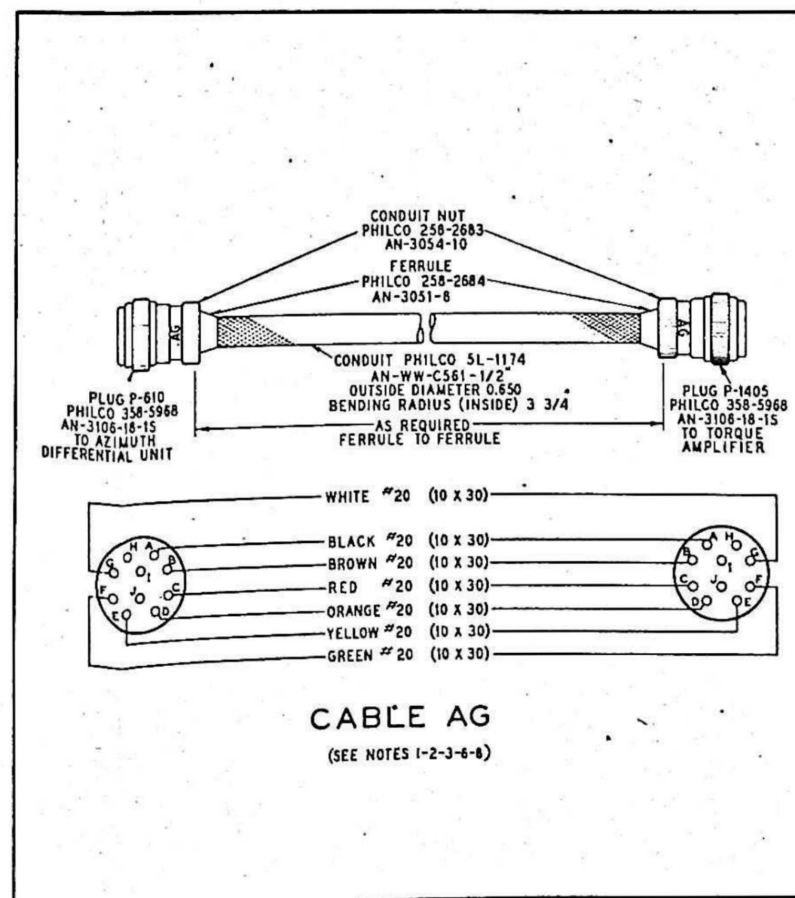
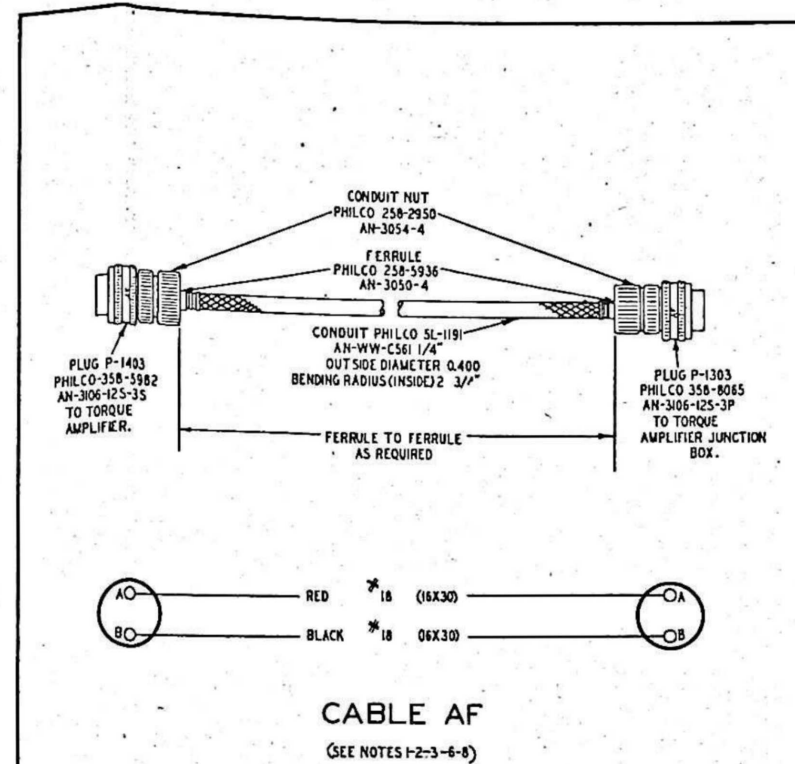
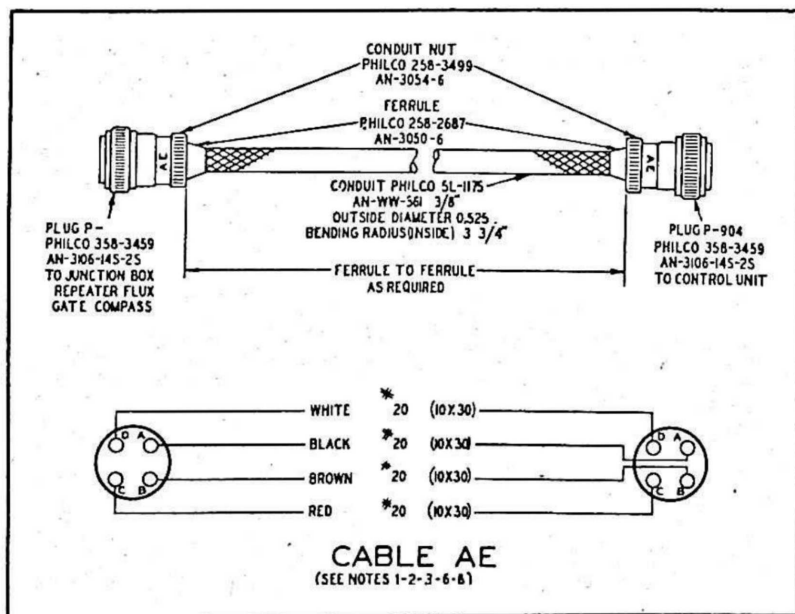
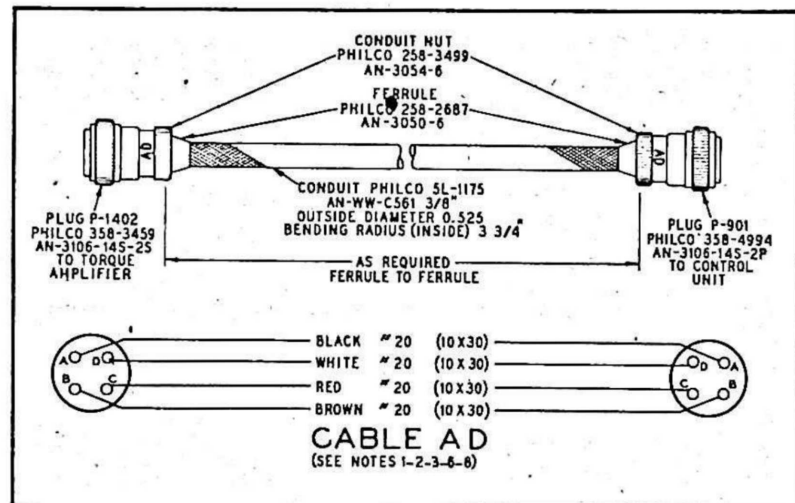
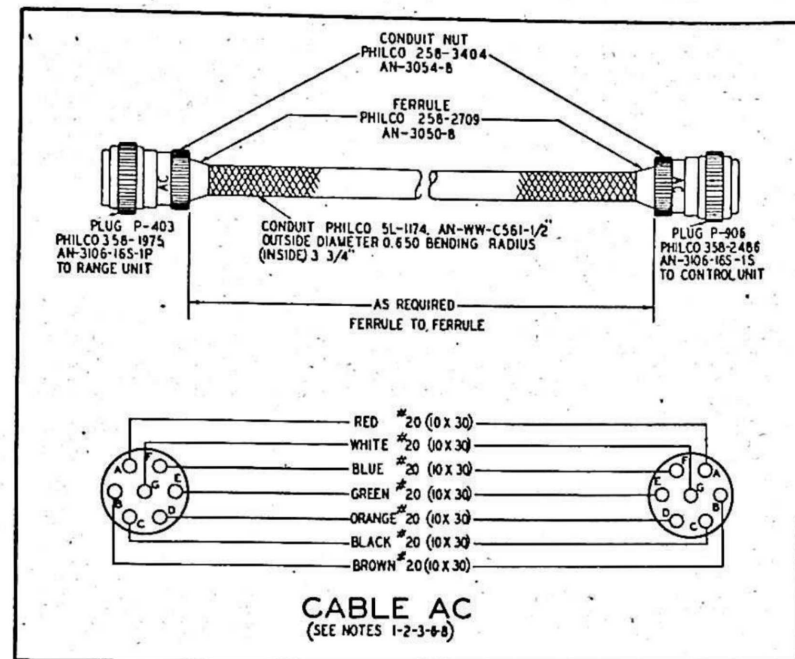
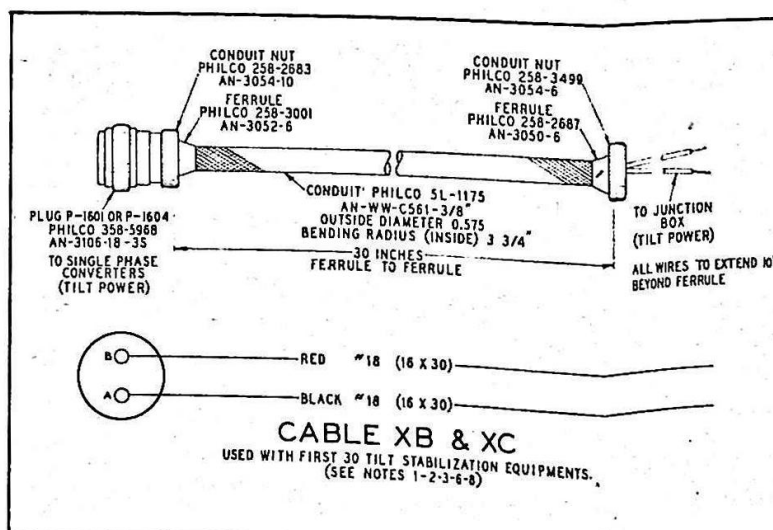
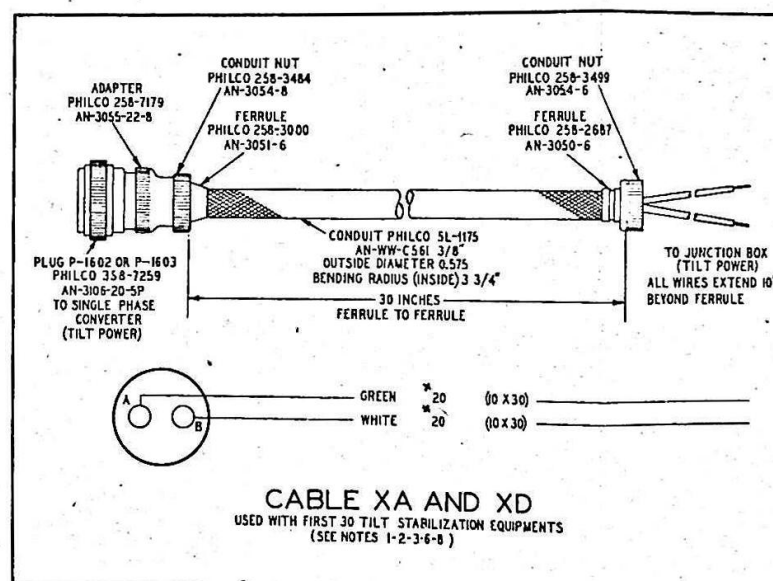
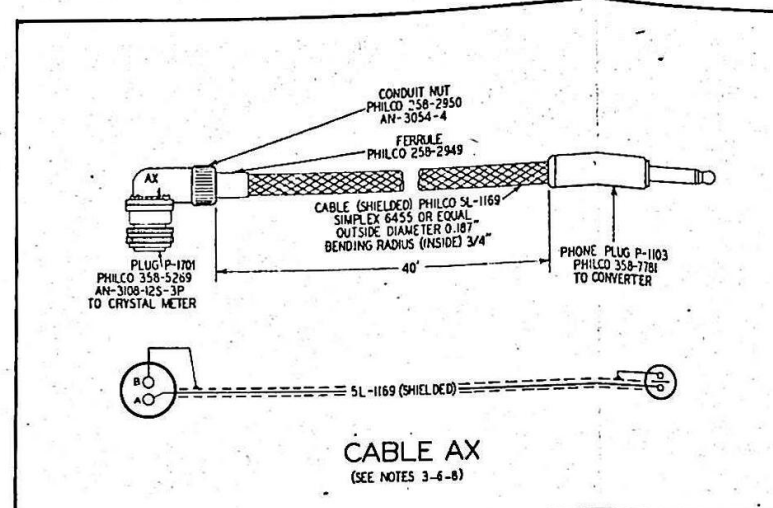
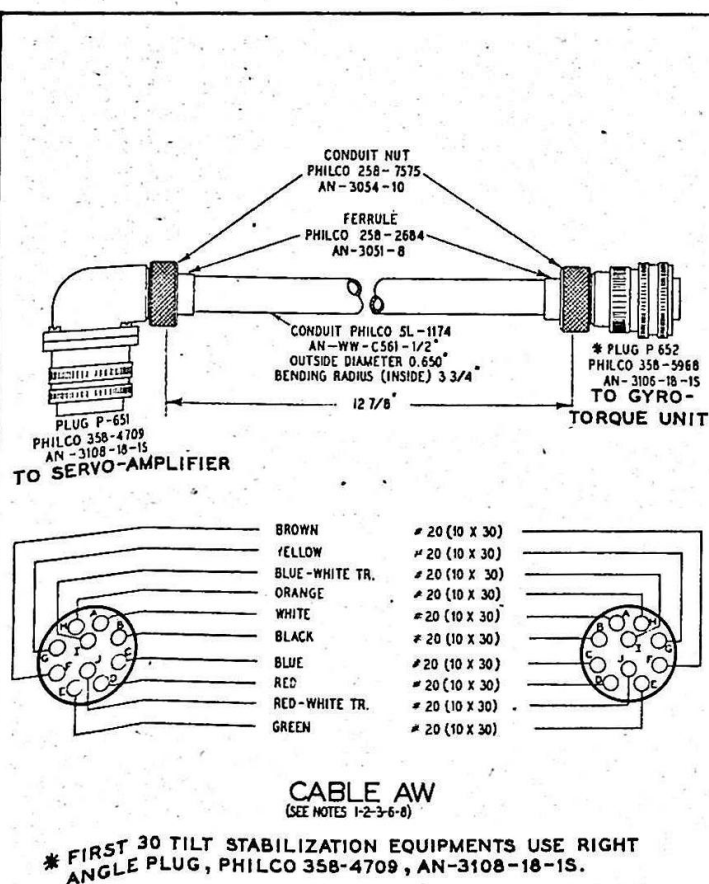
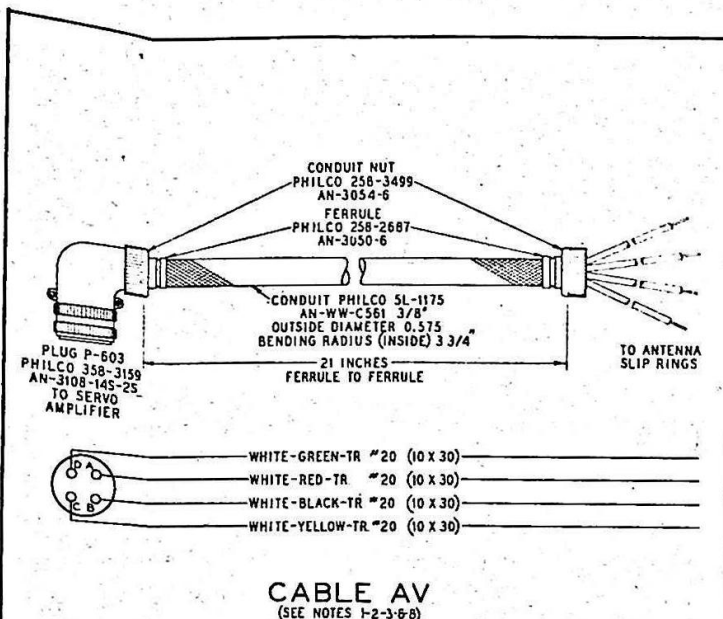


Figure 20—Cable-Assembly Details
(Sheet four of five)



CABLES AF, AG, AND AK FOR FIRST 30 EQUIPMENTS

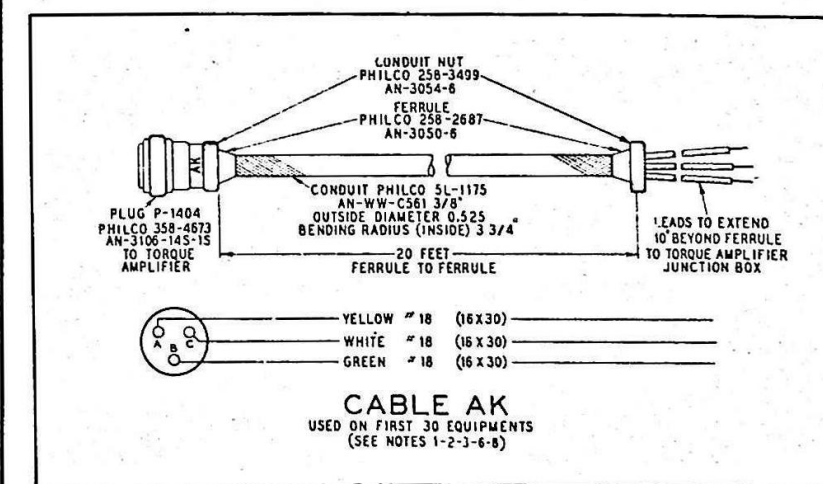
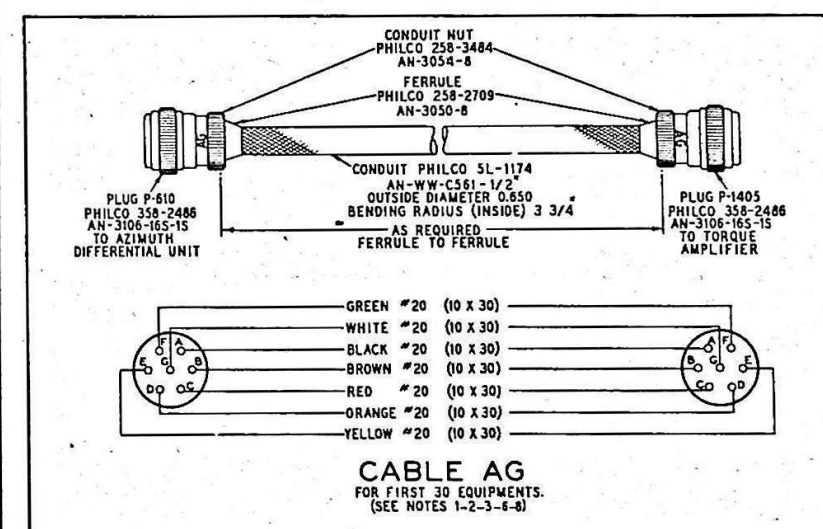
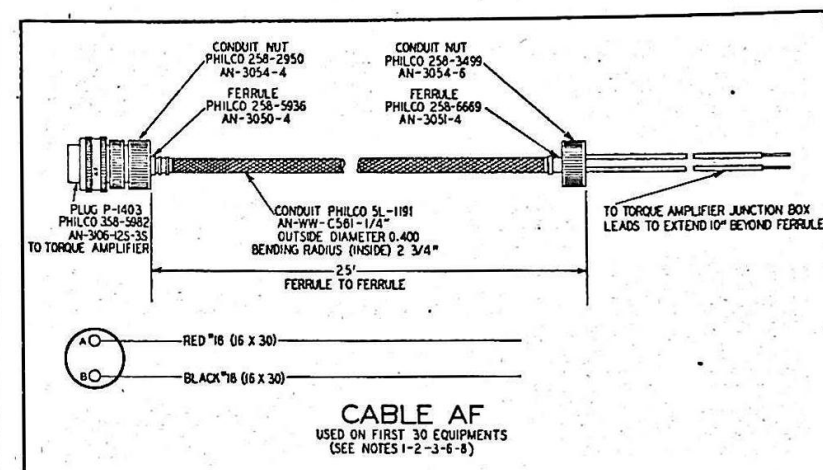


Figure 20—Cable-Assembly Details
(Sheet five of five)

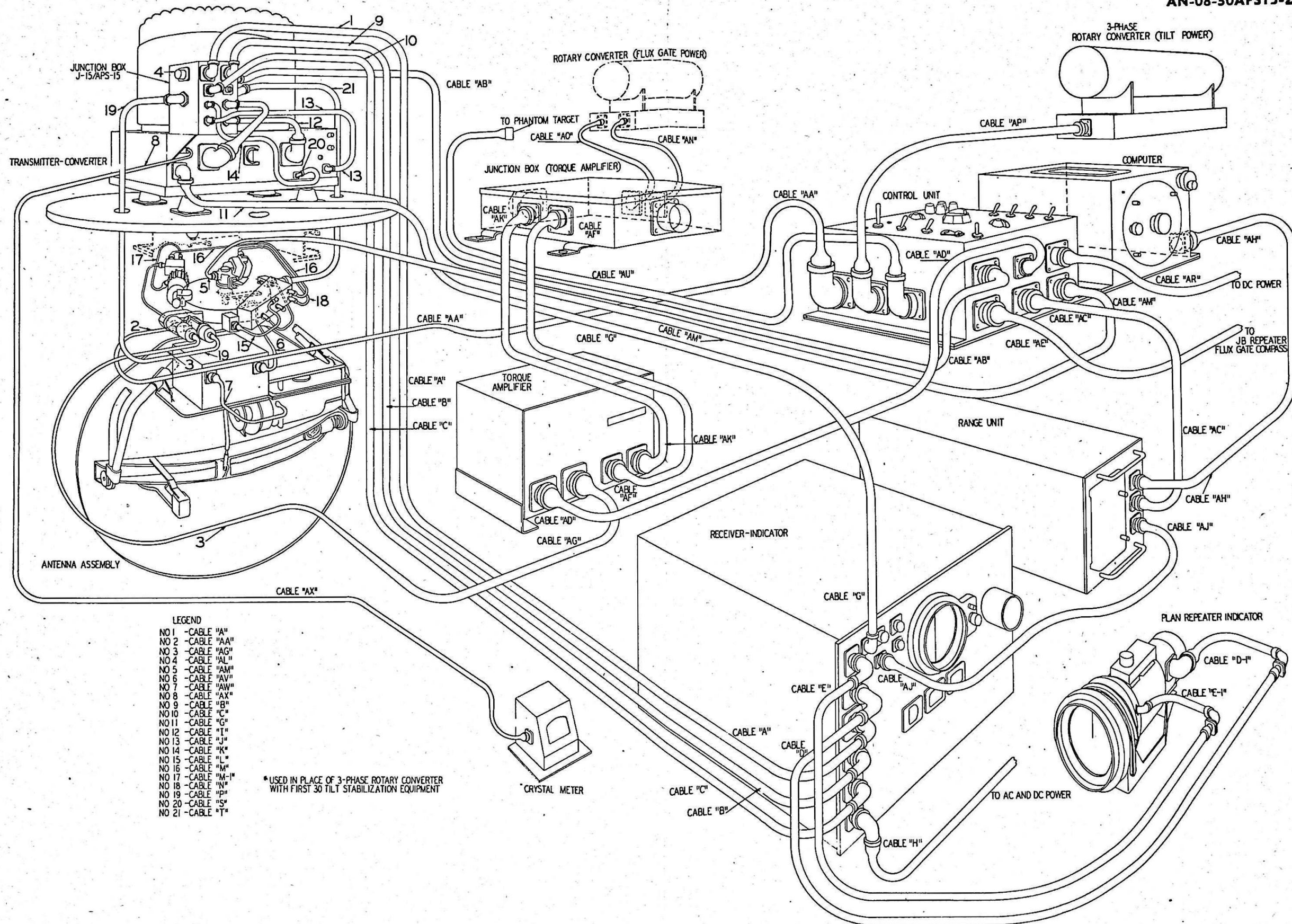


Figure 21—Cable Interconnections Between Units

